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On July 31 the Interstate Commerce Commission ordered the railways to include in operating expenses only the strictest and narrowest items of maintenance. The Chicago & Alton took this same action several years ago, if we remember right, and thereby got into serious trouble with the past grand master of the Interstate Commerce Commission. But, of course, that was a personal matter.

The objections to the use of the electric headlight on locomotives are not insuperable if they involve only occasional instances of either annoyance or delay. It well may be that they have compensations in other instances in the saving of time. It may also be that the comparative amount of safety in the use or the non-use of this high-power light would show a balance or net result in favor of it, although the glare of an approaching headlight tends to impair the eyesight of the engineman who faces it. The communication from H. A. Kennedy, assistant general manager of the Great Northern, and the accompanying reports which are printed in another column, are good evidence, but must be taken as evidence on one side only. The defects in the use of electric headlight are here made clear, but the corresponding advantages should also be considered. In the first place, the engineman behind

the electric headlight is apt to like it; he can see his track, his signals, possible obstructions and approaching trains at a much greater distance. More than this, he can detect an approaching train equipped with an electric headlight either around a curve or wherever the structural or topographical conditions obscure that approaching train, for the reason that the headlight's glare illuminates the air or trees or buildings in such a way that he is able to determine its position at great distances. On a single-track line this should add materially to safety. This, however, is the first opinion one is apt to form on this complicated subject; but the signal engineers, with no dissenting voice, tell us that on a block-signalized road it is unsafe for the engineman to rely on any other guide than that of the signals; that is, sole reliance must be placed on the lights and position of the blade; that the human mind is so constituted that it cannot serve two masters; that it cannot accurately and invariably obey the signals unless the attention is centered on the one subject alone in determining clear track or obstructed track. The laboratory test carried out by Dr. Chamberlain for the Great Northern Railway was an undertaking to find out the effect of the electric headlight on the eyesight of an engineman on a busy double-track road, frequently meeting and passing these high-power lights. Both he and Max Toltz, the consulting engineer, appear to have come to positive conclusions which require either refutation or else proof of more than corresponding advantages.

THE PASSING OF A RAILWAY CRISIS.

The present time marks almost exactly the end of a period of two years since the panic of 1907 fell upon the railways as upon other interests of the land. It also marks, as definitely and clearly as any interpretation of signs can, the close of the period of depression, financial and industrial. That is to say, in the case of the railways we have reached a point of recovery where any danger of serious reaction seems past and the future movement must be indefinitely upward. There is no other meaning to the steady advance in railway earnings, gross and net, the net decrease of idle cars in less than two months from 259,697 to 106,677—and to the latter figures from 332,513 in about eight months—the rise of railway stock values, the orders for new equipment and the revival of plans for extensions and improvements. It is true that the railway bond market, so remarkably enlarged earlier in the year, has begun to sag off; but that reaction is probably brief, and is well-nigh lost in the pervasive and greater symptoms of railway uplift which, if it continues, by increasing the security of the railway bond must expand its market again. Added to the railway omens are the trend of the returns of general trade, which necessarily become a reflex of railway business. And even the death of such a potential and highly individualized railway magnate as Mr. Harriman has failed to shadow deeply a situation which it would have complicated gravely last year.

With the crisis over and railway recovery now a realism comes the opportunity for a broad and landscape view of that long and trying two years of emergency and strain through which the railways have passed. Other periods have been worse. There have been panics more acute, crises more enduring, greater falls in railway values. But never before have the railways been so made the targets of events and a special interest so singled out for attack. They have had to endure the federal "big stick," adverse state legislation in many forms, and popular ill-feeling, rising at times to epidemic proportions and, too often, reflected in the rulings of demagogical state commissions. But these, bad as they were, bulked, on the whole, less than certain economic forces and conditions that also made the railways their objective point of assault. Organized labor on the railway refused the reduced wages which the factory

could enforce by the threat or the fact of closing, while the railway, as a public service "going" concern, could not enforce them. The railway could and did reduce the actual volume of labor, but did so necessarily at the cost of reduced service, with corresponding public criticism. The railway also, especially in the case of the greater systems, was caught at the outset of the depression in a time of extensive improvements and the financing of them. Finally, and, in some respects, most serious of all, the railway, in the existing condition of public feeling, could only in the slightest degree and in few instances find relief in an upward readjustment of freight rates or passenger fares. The ordinary consumer, if a sufferer by higher cost of commodities, could, generally speaking, as a producer, more or less make good by higher prices of his product. Not so the railway. It could not increase the charge for its own product—namely, its service—while paying the higher price for the products of others; and, as against legislatures and commissions, it was lucky if it could maintain even its existing charges.

Looking back upon such uniquely adverse conditions of the critical period passed, one must marvel that the railway has pulled through with so slight a record of disaster, with receiverships so few, with dividends rarely passed and not in many cases even lowered, and with almost no defaults of interest on bonds. But it is to be remembered that if in the railway depression there were exceptional elements of evil there were also special elements of resistance. If labor was more highly organized, so was the railway—organized not merely officially, but mechanically. As a high organization it could economize scientifically and with the minimum of public friction. In railway capital there was the same organization with, what was of more importance, concentration added. No financial crisis has ever fallen upon the country when there has been a closer relation between the railway and the great banking interests and more centralized fiscal resources at command. The panic of 1907 has been called a "rich man's panic"; but, if so, it was one in which the rich man was not so badly crippled that he could not lend a stout hand in emergency with the railway as one of his chief beneficiaries. And another important, if not vital, defense to railway adversity was substantial harmony among the railways themselves. Hard times among competitors are apt to promote the "grab" for business. During the crisis ended, if not entirely lacking, the "grab" was at least reduced to low terms, perhaps due to the outside onsets which compelled harmony of the railways in resistance. It is another of the modern applications of the fable of the power of the faggot as against the single stick—albeit a "big stick."

In the benign emergence of the railway from the stress of the extinct crisis it is this lesson on the value of organization, fiscal centrality and harmony which impresses itself. Not again, probably, in the future history of the American railway will it encounter during a time of industrial shrinkage such a combination of external foes as beset it during the gloomy months of 1908. But, if it does, neither are its powers of resistance likely to be less nor the experiences of the critical period just ended to be less suggestive as a precedent.

MR. HARRIMAN'S WAY OF WORKING

The most striking of all the facts connected with Mr. Harriman's career was the personal grasp which he had of the entire range of problems presented, combined with the prophetic sort of statesmanship which enabled him to find the vantage point in every bad situation; to make profit out of panics, and to buy and build unerringly for the future. He kept the details always with him. The machinery through which this was accomplished has been unlike that of any other great railway, the most conspicuous point of difference being the scarcity of head-office vice-presidents. The organization of the Harriman lines is in the highest degree di-

visional, and Mr. Harriman himself was the direct source of authority for all departments. Possible exception to this statement might be made in the case of the traffic department. Traffic arrangements and agreements and the development of existing resources are, in effect, a complicated and highly technical form of salesmanship, differentiated quite sharply from what may be called the department of railway strategy, that opens up new country, and from the physical and financial control of existing lines. Mr. Harriman probably did less personal directing in the traffic department than in any other part of the organization of his properties. He had high confidence in Mr. Stubbs, and the nature of his relations with this branch of the business was that of consultation and co-operation rather than direct control.

The way in which even small details of maintenance and operation were settled on the Harriman lines is, we believe, without parallel in great railway systems. Each of the broader operating divisions had its vice-president and general manager—men of long experience and high executive ability. In handling the property as it stood, these men were to all intents absolute. Physical changes, however, even small ones, such as the construction of new sidings or small stations at junction points, were passed to Mr. Kruttschnitt, director of maintenance and operation, in the form of recommendations. Mr. Kruttschnitt has had in his mind at all times a perfectly clear and comprehensive picture of the physical condition of the entire Union and Southern Pacific system. It is his duty not only to pass as an expert on the specific improvement contemplated, but to view it in its relation to the system as a whole; to see to it that development is even, systematic and well proportioned. Satisfied on this point, he would pass sheafs of memoranda through to the New York office, and they would be gone over by Mr. Harriman in groups, with incredible rapidity, and yet with full knowledge of all the subject matter before him. He would pass upon a million dollars' worth of improvement work, scattered over 10,000 miles of railway, in fifteen minutes, and this not in a perfunctory manner, but with full understanding of detail.

This system of administration had its drawbacks. Complaints were made, doubtless with justice, that certain important small improvements were delayed unnecessarily, waiting for their turn to be presented, like candidates for a degree, before the president. But, on the other hand, it is certain that this process enabled Mr. Harriman to know, as he could not otherwise have known, the exact condition of his property at all times, and the property benefited thereby. He had to have a special kind of brain to do this work, and no one man is likely to attempt it again, but in Mr. Harriman's case the ultimate results were beyond question.

All matters relating to the direct finances of the properties, to the income, expenditures and cash position, reached Mr. Harriman through Mr. Mahl, who performed the functions which occupy a good part of most railway presidents' time, since he regarded the finances always in their direct connection with the physical aspects of the property. Mr. Mahl knew the system perfectly, and his recommendations looked beyond the immediate present. His advice also carried great weight in the matter of the dynamic finances, as against the static ones; the disposition of the surplus funds, and the shifting of free assets in the form of securities of other companies, that have played so important a part in the history of the Union and Southern Pacific systems. Mr. Harriman had to delegate, for the most part, supervision over the companies' purchases, and to effect this he organized what is doubtless the strongest and best-equipped purchasing department possessed by any railway in the world.

Mr. Harriman worked closely with Kuhn, Loeb & Co. and with the National City Bank, and these great houses doubtless co-operated fully in the formation of important financial plans; yet there can be little doubt that final decision rested almost wholly upon Mr. Harriman, even when he and his

financial supporters were far apart in their views. For advice not only in legal matters, but in regard to broader questions affecting general development policy, Mr. Harriman relied strongly on his close friends and associates, Judge Lovett and William D. Cornish, until Mr. Cornish's death last year. Mr. Cornish was nominally vice-president in charge of the land department, but his advisory functions extended far beyond this. He was at once counselor and administrator. Mr. Harriman recognized fully his debt to these two strong men, and their part in the development of the Harriman system as it now stands was doubtless much greater than has generally been understood.

Coming into his position of great executive responsibility from a highly successful career as a stock broker, Mr. Harriman preserved many of his characteristics of that vocation. The Stock Exchange is open from 10 to 3, and outstanding matter must all be definitely concluded within those hours; there must be no half decisions or uncertainties. Until the doctors laid down strict rules of procedure during the last year or so Mr. Harriman used to come to his office about half-past 9 in the morning and work with furious energy until 4 or half-past 4 in the afternoon, having his lunch brought in to him, but paying very little attention to it, and allowing countless interruptions during the meal. During the last year or so he kept much the same office hours, except that he was accustomed to leave the city Thursday night for a long week-end.

Until the last year or so Mr. Harriman had another stock broker's characteristic in being quite heedless of public opinion. He saw clearly what he proposed to do; if other people did not understand it it apparently made very little difference to him. It is safe to say that nine-tenths of the bitter public criticism to which Mr. Harriman was subjected was founded on plain misunderstanding, eagerly seized by shrewd people and played up for political purposes. We wish he had kept away from the New York state politics that were largely an amusement to him; we wish he had possessed a sharper perception of the importance of working in the daylight; of making it clear to all that he was not abusing his trusteeship on the many occasions when he was unjustly accused of it. It will probably be a long time before history does him full justice, but we believe the time is coming when it will be recorded not only that he was the greatest constructive railway organizer and developer that America ever produced, but also that his personal rewards were insignificant, and that, for the work he did, he was poorly paid in money and scarcely paid at all in public appreciation.

AN OLD-FASHIONED COLLISION.

The general manager of the Spokane & Inland Empire Railroad Company has sent us a copy of a report made by a special investigating committee on the collision which occurred at Gibbs, Idaho, on that line, July 31, and which was reported in the *Railroad Age Gazette* of August 6, 13 and 27. In this collision 13 persons were killed and about 100 injured. For more than two weeks previous to the accident the road had been crowded with passengers in consequence of the rush to secure cheap government lands, which were to be allotted early in August. The investigating committee consisted of nine citizens appointed by the Chamber of Commerce of Spokane and Coeur d'Alene and by the officers of the railway company—a fact which would seem to indicate that the fashion of publicity, set by the Southern Pacific, is sufficiently popular in Idaho and Washington to have led to its adoption by another company. Of the nine members of the committee one was a county prosecuting attorney, one a city prosecuting attorney and one a city counselor; one was a mayor, one an ex-mayor and the others were business men. One of them is described as an ex-railway man.

The facts of the collision are briefly told. Westbound special train No. 5 encroached on the time of eastbound regular train No. 20, and the cars of the westbound train were badly crushed. The eastbound train had been brought to a stop before the collision occurred. Our advices were to the effect that the westbound train, which suffered far the worst damage, was composed of cars lighter than those in the eastbound; but the report before us says nothing on this point except that "both trains were of modern equipment and in perfect condition." The collision occurred only a short distance from Coeur d'Alene, the eastern terminus of the line.

The principal facts found by the investigating committee, in addition to the foregoing, were that the road was operated under standard code rules; that the trainmen were competent and of many years' experience, both on steam and electric railways; that during the rush they had been obliged to work from one to three hours overtime daily, but that this in no way affected their efficiency; that the men and cars for the westbound train were late in reaching the terminus from the west, and the orders for their westbound trip were issued before they arrived; and that the assistant trainmaster received and receipted for these orders contrary to rule. The order specified that No. 5 should meet special No. 4 at Allan. No. 5 was bound to keep out of the way of eastbound No. 20 under the rule which makes extra trains always inferior to regular trains. The assistant trainmaster delivered the order to the conductor, at the same time telling him that eastbound No. 20 was late; and he instructed the conductor to pull his train down nearly to the switch, where No. 20 would enter another track to clear the way for No. 5. The conductor gave this instruction to the motorman and delivered to him a copy of the order; but he did not require the motorman to read the order aloud in his (the conductor's) hearing, as required by the rule, and he also failed to exhibit the order to either of his two brakemen. Neither of the brakemen had any knowledge of the order. Having instructed the motorman, the conductor went into the car and immediately began taking tickets, but the motorman kept right on, regardless of No. 20, and the conductor did not notice that he failed to stop before reaching the switch. Approaching the point of collision the motorman might have seen the eastbound train 800 ft. away, but he did not observe it until within 250 ft. of it. He was then so startled that he did practically nothing to slacken the speed of the train. Having made an experiment with a train similar to No. 5, the members of the committee find that, at the estimated speed, the train could have been stopped within 200 ft., and this failure of the motorman to keep a good lookout is named as an element in the cause of the wreck. The only excuse offered by the motorman is that he understood his meeting order as referring to No. 20 instead of special No. 4. The committee says that "he either misread the order, substituting the words and figures 'No. 20' for 'Special 4 East,' or that his (claim of) misconstruction of the order given him is made to excuse him from responsibility for the collision."

This report is worthy of notice as being more intelligent and succinct than is usually to be expected from a non-expert committee; but it is also noteworthy as giving no light whatever on the question of preventing such disasters in the future. The tone of the report is that of dependence on the Standard Code, with an assurance of safety as complacent as that of the Jews reproached by John the Baptist, who depended for salvation on the fact that they were sons of Abraham, but who, nevertheless, were utterly condemned. The conductor left to the motorman alone a duty which rested jointly on himself and the motorman—the duty of keeping clear of the eastbound regular train. Both he and the motorman neglected the reading of the order aloud, and the rule requiring orders to be shown to brakemen was also a dead letter. These requirements were disregarded by experienced men. In the absence of any light as to whether these rules had been habitually enforced the almost inevitable conclusion, guided by general experience,

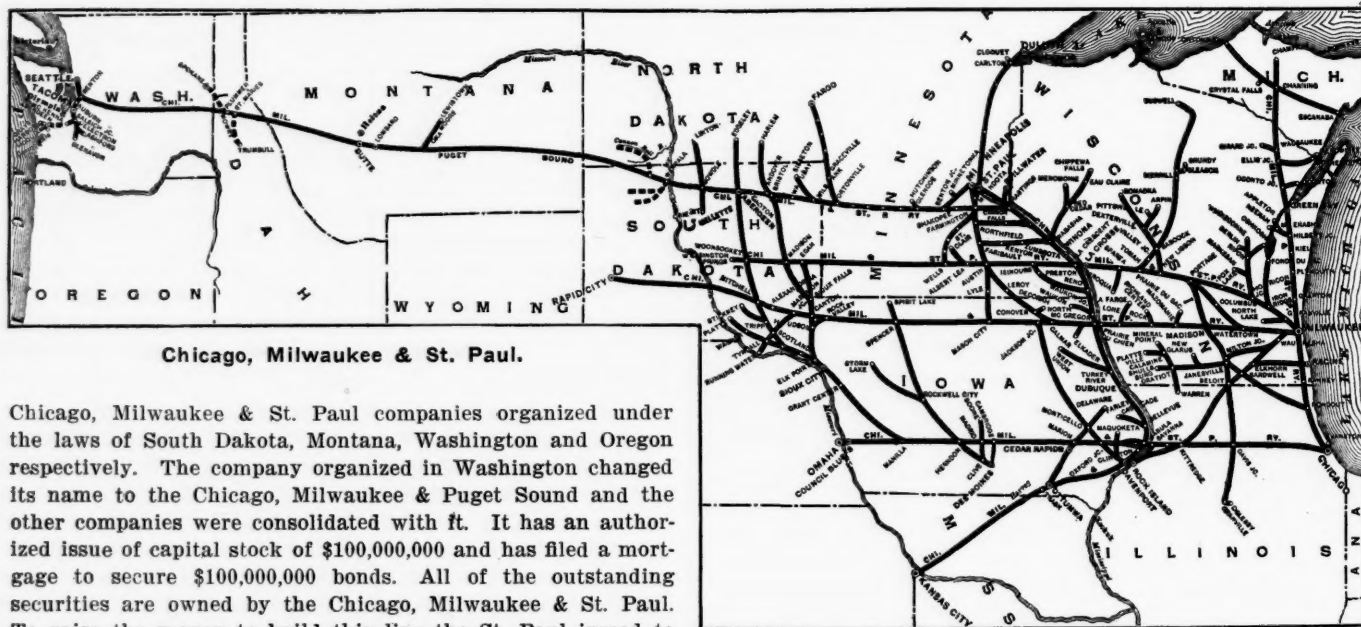
is that they had not. The Standard Code is no better than one that is unstandard, except as it is enforced. This is the simple lesson of the collision if we are to try to run trains by time intervals and train orders. The other lesson, equally simple, is that the only generally accepted cure for the well-known weaknesses of the Standard Code, or, more accurately, the weaknesses of those features of the Standard Code which are designed to secure the safety of trains without the regular use of the space interval system, is the adoption of the block system. The Southern Pacific has established an advanced standard, worthy of imitation, not only in the matter of frank publicity of unpleasant facts, but also in rapid introduction of the block system.

CHICAGO, MILWAUKEE & ST. PAUL.

In July the entire main line of the Chicago, Milwaukee & Puget Sound (the Pacific coast extension of the St. Paul), extending from the Missouri river to Tacoma and Seattle, was opened for certain classes of traffic and in a short time the road will be in operation for both passenger and freight traffic. This line, about 1,390 miles long, was built by four

need of working capital. The balance sheet showed but \$1,900,000 cash on hand as against \$8,400,000 on June 30, 1908, and there were total current assets of only about \$6,400,000, with total current liabilities of \$10,200,000 in 1909. This is not considering advances to other companies as a current asset. The sale of the debentures since the date of the report will have provided working capital.

The St. Paul has a rather erratic way of carrying large sums on its balance sheet charged to unexplained accounts. For instance, in 1908 it carried bills receivable at \$61,000,000 and in 1909 no bills receivable are shown. This doubtless represented the account with the construction companies, but a balance sheet with such large unexplained items is imperfect from the stockholder's standpoint. In 1908 bonds and stocks of other companies were carried at \$20,000,000 and in 1909 at \$105,500,000. Advances to other companies amounted to \$2,550,000 in 1908 and to \$20,200,000 in 1909. Much of the shifting back and forth of accounts probably represents transactions with the subsidiary company—the Chicago, Milwaukee & Puget Sound. If this is correct the value of the Pacific coast extension, as carried on the books of the St. Paul, was roughly \$83,000,000 in 1908 and \$125,000,000 in 1909.



Chicago, Milwaukee & St. Paul.

Chicago, Milwaukee & St. Paul companies organized under the laws of South Dakota, Montana, Washington and Oregon respectively. The company organized in Washington changed its name to the Chicago, Milwaukee & Puget Sound and the other companies were consolidated with it. It has an authorized issue of capital stock of \$100,000,000 and has filed a mortgage to secure \$100,000,000 bonds. All of the outstanding securities are owned by the Chicago, Milwaukee & St. Paul. To raise the money to build this line the St. Paul issued to its stockholders at par \$99,500,000 new stock, \$66,530,000 being preferred and \$32,970,000 being common. When the Pacific coast extension was undertaken it was estimated that it would cost about \$40,000 per mile to build. The St. Paul itself, that is, the road lying east of the Missouri river, had outstanding June 30, 1909, \$232,600,000 stock and \$115,800,000 bonds. Subtracting the stock that was issued to pay for the Pacific coast extension, or, in the words of the president's report, "the stock that was issued for the acquisition of the securities of the Chicago, Milwaukee & Puget Sound," the St. Paul is capitalized at slightly over \$34,000 per mile. Taking the mileage of the extension at 1,400 miles it is apparently capitalized, roughly, at \$70,000 a mile. Of course this is a very rough estimate, the mileage probably being considerably greater, as there are now being built a number of miles of branches, but the capitalization will also probably be greater than the figure that we have taken in making this estimate.

In June it was understood that the company had made arrangements to sell \$25,000,000 5 per cent. debenture bonds to Kuhn, Loeb & Co., but no mention of this is made in the annual report, so if the sale was made it must have been since June 30. At the time arrangements were being made for the sale it was said that the money received would be used largely for paying for branches to be built on the Pacific coast extension. On June 30 the St. Paul was very much in

Officers of the St. Paul say that that part of the Pacific coast extension running from the Missouri river to Butte, Mont., which has been in operation a little over a year, is paying not only its own expenses but interest on its cost as well. The 1909 fiscal year was a prosperous one for the St. Paul itself. Total operating revenue amounted to \$59,900,000, an increase over the previous year of \$2,960,000. Freight revenue amounted to \$42,300,000, an increase of \$1,900,000, or a little less than 5 per cent., over the previous year, while the passenger revenue increased by 7.5 per cent. and amounted in 1909 to \$12,800,000.

Operating expenses amounted to \$38,700,000, an increase of \$1,600,000. Nearly all of this increase was in the cost of maintenance of way and structures. The following table shows the unit costs of maintenance:

	1909.	1908.
*Maintenance of way	\$786	\$700
Repairs per locomotive.....	2,001	1,952
" " passenger-train car.†...	487	494
" " freight-train car.....	67	62

*Per mile of first, second, third, etc., track operated, two miles of sidings, and switch tracks being counted equal to one mile of main track.
†Including sleepers, all of which are owned by the St. Paul.

The total number of tons of freight carried was 27,500,000, an increase of 1,300,000 tons over the previous year, and the revenue per ton per mile was 8.382 cents, or about 3 per cent. more than in the previous year. The average train load was

274 tons in 1909, almost exactly the same as that of 1908.

The number of passengers carried one mile was 674,000,000 in 1909, an increase of nearly 9 per cent. over 1908, and the revenue per passenger per mile was 1.895 cents, an increase of about 1 per cent.

The traffic results of the operation of the Pacific coast extension west as far as Butte is not shown by any great change in the proportion of tonnage of the various classes of commodities carried by the St. Paul. Products of agriculture furnished 5,870,000 tons of freight in 1909 and 5,640,000 tons in 1908. This is about 21 per cent. of the total tonnage in each year.

During the past year the company did not pay dividends on any of the \$99,500,000 new stock issued but did pay interest at 7 per cent. on the paid up portion of stock subscriptions. Dividends of 7 per cent. are being paid on both the common and preferred stock, and in the 1910 fiscal year the full 7 per cent. will have to be paid on the \$99,500,000 new stock. This will amount to \$6,965,000. After the payment of dividends the company had a surplus of \$3,800,000 in 1909. If the Pacific coast extension takes care of itself without doing anything to help the St. Paul pay the amounts due in dividends on the new stock it will be doing fully as well as any

CHICAGO & NORTH WESTERN.

The Chicago & North Western owned 7,515 miles of track on June 30, 1909, as against 7,266 miles owned by the Chicago, Milwaukee & St. Paul. This statement, however, excludes the new railway built during the year under the corporate style of the Chicago, Milwaukee & Puget Sound, which was opened July 1, 1909, with a main line 1,390 miles long and 520 miles of branches building.

Prior to the building of this extension the St. Paul and the North Western were close competitors throughout the granger States, the principal difference being that the St. Paul occupied, in the main, the northerly position, and had a heavier branch-line mileage in the territory between the Twin Cities and Chicago, whereas the North Western had the greater mileage in southern Iowa, was strong in Nebraska and Wyoming, not entered by the St. Paul, and had a considerably greater mileage in Michigan.

In a single year, therefore, so far as the traffic situation is concerned, the St. Paul has become a transcontinental line, instead of the great local line which it formerly was; a change which was advisable, not only on account of direct traffic possibilities, but because of the growing strength of the affilia-



Chicago & North Western.

new road might be expected to do. It is therefore necessary for the St. Paul itself to earn \$3,165,000 more net income next year than it did in 1909 to enable it to pay these new dividends. This it ought to manage. Crops, while they are perhaps not going to be as large as was estimated a couple of months ago, will certainly be up to the average, and during the past year the St. Paul spent rather more than usual on the up-keep of the property and the maintenance of equipment, so that it should be in good shape to handle the increase in traffic that improving business conditions will furnish. Also the Pacific coast extension should make it possible both directly and indirectly for the St. Paul to secure a good deal more business.

The following table gives a comparison of the operations of the road in 1908 and 1909:

	1909.	1908.
Average mileage operated.....	7,512	7,499
Freight revenue	\$42,341,651	\$40,426,395
Passenger	12,774,852	11,883,395
Total operating revenue	59,897,463	56,932,621
Maint. way and structures.....	7,288,603	6,451,588
Maint. of equipment.....	7,270,774	7,079,429
Traffic	1,334,006	1,281,683
Transportation	21,764,471	21,246,549
Total operating expenses.....	38,731,239	37,163,368
Taxes	2,428,676	2,304,962
Operating income	18,737,549	17,464,290
Gross corporate income.....	18,967,918	18,494,043
Net corporate income	13,112,201	12,577,283
Dividends	9,315,614	9,308,040
Surplus	3,796,587	3,269,243

tion between the Harriman lines and the Chicago & North Western, making it difficult for the St. Paul to get its share in long-haul business.

As the situation stands the North Western seems most unlikely to extend to the coast, at least for a great many years. Geographically, it is tightly bottled up by the Wyoming and Montana mountains; strategically, it is in receipt of a lucrative traffic from the Harriman lines to the westward, which those lines would have no interest in giving it if it had its own connection with the coast. The acquisition by the Harriman interests of the Illinois Central, with its line from Omaha to Chicago, does not seem to have changed this pleasant relation. The North Western is a very important ally, representing, as it does, the best traffic territory in the granger part of the West, and it seems wholly likely that it will long remain the great local line which it now is.

The North Western's 1909 year was not as good as the 1907 year either in gross or in net, but it was close to the 1906 year in gross, and presented a considerably more favorable record of operating expenses. Gross revenue in 1909 was \$65,978,471 and total net revenue, prior to taxes, amounted to \$22,787,232; freight revenue contributed \$43,619,091 of the total and passenger revenue, \$16,875,668. The average ton-mile revenue increased from 8.7 mills to 9 mills, whereas the average haul decreased from 158 miles to 148 miles during the year.

It is understood that the Chicago & North Western has approximately 6,700 shareholders, although the extremely high price of the stock, even in the panic year, has kept it strictly in the category of a high-class investment stock that looks costly to everybody but the man who takes into consideration the underlying earnings for a series of years. The road earned approximately 13 per cent. on its total outstanding capital stock this year, a little over 11 per cent. in 1908, approximately 13 per cent. in 1907 and almost 15 per cent. in 1906. In 1905 it earned about 14 $\frac{1}{3}$ per cent.; in 1904 almost 13 per cent. The effect of this continued prosperity in good times and bad is being looked for with great interest. The company has no apparent need for large amounts of new capital, having a strong cash position and a system extremely well maintained on the main lines and plenty well enough maintained on the branch lines, the latter constituting the greater proportionate part of its mileage. The long-continued record of conservatism and good management has earned a reward, but whether or not this reward can be paid during the present attitude of the public mind in the granger States is an interesting question.

Satisfactory progress has been made during the year in the construction of the company's new passenger station and approaches in Chicago. The Chicago track elevation work has been substantially completed on the South Branch and the Galena division and five miles of new track elevation in Evanston, Ill., has been undertaken. Extensive track elevation has also been begun in Milwaukee. The company has acquired by purchase during the year the following railways, which were built in its interest and formerly operated by it under lease:

The Manitowoc, Green Bay & North Western, extending from Manitowoc to Eland Junction, Wisconsin, and from Pulaski to Gillett, Wisconsin, 123 miles; the Milwaukee & State Line Railway (double track), extending from near Lake Bluff, Ill., to near St. Francis, Wis., 50 miles. Total charges for "cost of property" aggregated \$15,509,799 for the year.

The unit costs of maintenance were as follows:

	1909.	1908.
*Maintenance of way.....	\$836	\$802
†Repairs and depreciation:		
Per locomotive	2,260	2,150
" passenger-train car	552	543
" freight-train car	62	50

*Per mile of first, second, etc., main track operated, two miles of switches and sidings being taken as equal to one mile of main line.

†Superintendence, shop machinery and tools and sundry expenses prorated.

The following table compares operations in 1908 and 1909:

	1909.	1908.
Average mileage operated	7,635	7,631
Freight revenue	\$43,619,091	\$41,949,630
Passenger revenue	16,875,668	15,734,607
Total operating revenue.....	65,978,471	63,219,344
Maint. of way and structures.....	8,422,265	7,978,439
Maint. of equipment.....	7,845,969	6,839,241
Traffic	1,127,864	1,080,580
Transportation	24,666,863	24,635,180
Total operating expenses	43,191,239	41,641,314
Taxes	2,714,632	2,582,823
Operating income	20,056,693	18,956,209
Gross corporate income.....	22,610,755	21,855,485
Net corporate income.....	13,935,294	13,638,691
Dividends	8,764,503	8,764,272
Surplus	5,170,791	4,874,419

NEW PUBLICATIONS.

How to Be a First-Class Trainmaster. Prize articles, reprinted from the *Railroad Age Gazette*. Pamphlet; 53 pages. Published by the *Railroad Age Gazette*, 83 Fulton street, New York. Price, 50 cents a copy; \$4 a dozen copies.

These essays, with which the readers of the *Railroad Age Gazette* are familiar, make a highly interesting description of the work of the officer who, on American railways, performs a large part of the interesting duties of the superintendent—duties which, by reason of the magnitude of his task, the superintendent is obliged to delegate. As the superintendent is in many respects the most active officer in the railway service, it is perhaps not unfair to say that these articles, all written by practical trainmasters, will be of interest, not only to railway men, but to the general reader as well. The prize winners

were C. B. Wildman, J. J. Pruett and F. L. Rodman. The last half of the pamphlet is taken up with a composite article composed of paragraphs from 15 other writers.

A Reinforced Concrete Pocket Book. By L. J. Mensch, M. Am. Soc. C.E., General Contractor, Monadnock Building, San Francisco, Cal. Press of Neal Publishing Co., 66 Tremont street, San Francisco, Cal. 216 pages, 4 $\frac{1}{4}$ in. x 6 $\frac{1}{4}$ in., 88 diagrams. Flexible leather. Price, \$10.

The compiler of this handbook is a contracting engineer who offers it neither as a text book nor as containing much original or exhaustive information, but rather the usual information for practical work conveniently arranged, and some of it in new shape. He expresses the hope that it will "promote the use of reinforced concrete and be the medium of its standardization." The book has numerous convenient tables, including areas and weights of square and round rods figured for 1, 4, 6 and 8, with allowance for stirrups and overlaps, and also for mixed sizes of rods; properties of various sizes of T-beams, slabs, wall and column footings and girderless floor construction; also tables of typical floor construction of varying loads, column centers, ceiling heights and different styles of floor slabs. The tables are clearly explained in the text and illustrated by examples and a typical building followed through in detailed design and computation of cost. There are full tables and explanation of form work excellently illustrated by diagrams. There follow discussions of Retaining Walls, Round Tanks, Reservoir Walls, Elevated Tanks, Grain Elevators, Concrete Dams, including arched and cantilever types, Water Pipes, Piles, Arched and Girder Bridges, Sheds, Chimneys and Trolley Poles, a brief discussion of labor cost and a typical general specification.

The book is not for the inexperienced or the student, and while the tables and much of the text are of value it is incomplete and does not suggest important additional information necessary. No authorities are quoted, or, rather, no credit is given for information from other sources than the writer's personal knowledge. There is little regarding practical construction work, much of which is essential to assumptions regarding theoretical design. Two important omissions are a discussion of the choice and grading of aggregate for purposes of economy, strength and impermeability and caution as to the importance of testing cement and the absolute necessity of constant and intelligent supervision and inspection of all details of concrete construction work.

Strength of Materials. By Arthur Morley, Professor of Mechanical Engineering in University College, Nottingham. Longmans, Green & Co., London, New York, Bombay and Calcutta. 487 pages, 5 $\frac{1}{2}$ in. x 8 $\frac{1}{2}$ in., 248 diagrams and illustrations. Cloth. Price, \$2.50; in England, 7s. 6d.

Of the seventeen chapters four are devoted to the theory of stress and strain, five to stress, deflection and bending of beams, one to twisting, one to pipes, cylinders and disks, one to bending of curved bars, one to flat plates, one to vibrations and critical speeds and three to testing machines and tests. There are numerous and excellent examples given, and at the end are answers with limited mathematical tables and an excellent index. The text is well illustrated by diagrams and excellent photographs of fractured metals and various testing machines. There is no description of experimental tests with comparison with the theoretical discussion, although a list of references is given regarding experimental tests of struts.

The book is primarily a text book for engineering students, and while the practical mechanic will find little which he can use in his day's work, unless he is an excellent mathematician, the mechanical engineer and designer will find much of value and considerable that is new. The discussion of eccentrically loaded columns is particularly complete, and of disks, hooks, rings, chain links, etc., unusual and interesting.

The practical scope of the book may be appreciated from the quotation of a few examples as follows:

Find the maximum safe load and deflection of a closely coiled helical spring made of $\frac{1}{4}$ -in. square steel having 10 complete coils 2 in. mean diameter.

A locomotive coupling rod is of rectangular cross-section

3½ in. deep and 1¼ in. wide. The maximum thrust in the rod is estimated at 10 tons and the maximum inertia and gravity load at 17 lbs. per inch length. The length of the rod between centers being 8 ft. 4 in., neglecting friction at the pins, estimate the maximum intensity of stress in the rod.

What must be the diameter of a solid shaft to transmit a twisting moment of 160 ton-feet and a bending moment of 40 ton-feet, the maximum direct stress being limited to 4 tons per square inch? What should be the external diameter of a hollow shaft if the internal is 0.6 of the external.

What must be the thickness of metal in a spherical shell 20 in. diameter, containing a pressure of 200 lbs. per square inch, if the greatest intensity of stress is not over 500 lbs. per sq. in.

A trolley wire ⅜ sq. in. in section has a span of 120 ft., a sag of 10 in. and weighs 115 lbs. per 100 yds. Find the tension of intensity in the wire.

A circular plate is 20 in. diameter and ¾ in. thick. If it is simply supported at its perimeter, what pressure per square inch will it stand if the intensity of stress is not to exceed 10,000 lbs. per square inch? (Take Poisson's ratio as 0.3.)

Mr. Morley includes practically all of the matter found in similar books and more. His methods are thorough and explanations clear. His contribution is one of undoubted value.

Engineers' Pocket Book of Reinforced Concrete. By E. Lee Heidenreich, M. Am. Soc. Test. Mat., M.W.S.E., M. Am. Inst. Min. Eng. The Myron C. Clark Publishing Co., Chicago and New York. E. & F. N. Spon, Ltd., London. 364 pages, 4½ in. x 6¾ in. 164 photographic illustrations and diagrams. Flexible leather. Price, \$3.00.

The author is a consulting engineer, who for some fifteen years has been largely occupied with the study, exploitation and construction of reinforced concrete. In 1900 he published a booklet on "Monier Constructions." For upward of eight years he has been writing, changing and improving the present pocket-book. Credit is given to various authorities, including French and German. There are seven chapters indexed in detail in the table of contents, and by a full index at the end of the book, but no special index of tables. The titles of chapters are "Materials and Machines Used in Reinforced Concrete Construction; Design and Construction of Buildings; Design and Construction of Bridges; Abutments and Retaining Walls; Culverts, Conduits, Sewers, Pipes and Dams; Tanks, Reservoirs, Bins and Grain Elevators; Chimneys, Miscellaneous Data, Cost Keeping, Estimating, Specifications, etc." There is included a glossary of terms used in plain and reinforced concrete work. The tables include percentages of voids of aggregate for different weights, solid and crushed, and specific gravities; various proportions of materials for one cubic yard of rammed concrete; the usual properties of steel squares, rounds, flats, wire, I-beams and angles; values of K for various proportions of steel; maximum bending moments in slabs according to straight line formula; safe loads and steel areas for beams; safe loads per square foot and steel area for slabs; various loads and dimensions with concrete and steel areas for hooped columns; pressures of grain and coal in bins; wind velocities and pressures and others pertaining to the subject. The application of all formulas and use of tables is well illustrated by examples.

The author handles his subject in a consecutive and intelligible manner, with lucid explanations of the theory of design and excellent description of the details of construction, supplemented by description of tools and appliances of a sufficient, but not large, number of manufacturers. Many suggestive and valuable examples of the practical details of construction are given. The writer has had much special experience in the design and construction of grain elevators and bins and gives valuable information. Under miscellaneous data excellent cost and estimating forms are given.

In general the book is a "concrete storehouse" of valuable information and one of the best of its class. In a future edition Table XXXVII, showing floor loads specified by various cities, should be later than 1906, and there can be added with advantage some discussion of concrete as fire protection and its behavior in the fires at Baltimore and San Francisco; also

description and explanation of some of the failures of concrete structures.

Letters to the Editor.

ELECTRIC HEADLIGHTS ON THE GREAT NORTHERN.

St. Paul, Minn., Aug. 24, 1909.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

I take pleasure in submitting herewith copies of reports made by Dr. J. W. Chamberlin, ophthalmic surgeon, covering a test made February 21, and also copy of a report of Mr. Max Toltz, railway consulting engineer, in connection with test of February 24, and blueprint which gives the result of the test in detail. I am also enclosing copy of a report made by Superintendent Leverich, of our Minot division, in connection with an actual occurrence where the eyesight of an engineer in service was so affected by the glare of an electric headlight on an opposing train that he was unable to discern the color of light displayed on semaphore signal, and which occurrence resulted in delaying a passenger train.

H. A. KENNEDY,
Assistant General Manager.

SUPERINTENDENT C. E. LEVERICH'S REPORT.

In regard to delay to extra 1837 at Minot, by reason of glare of headlight on train No. 1 standing at the passenger station. I attach hereto blueprint as asked for and have shown thereon the place where No. 1's engine stood, also the place where engine 1837, the extra east, stood. Engineer on extra 1837 advises that when approaching the Soo Line crossing he called for the passing track, but on account of the outgoing engine standing on passing track with electric headlight burning he could not see whether or not semaphore or home signal was clear, consequently stopped his train. All this time No. 1 had not yet shown up and the engineer on the 1837 thought that possibly the outgoing engine would back up into siding near the service building and let him by. A few minutes after that No. 1 arrived and the change of engine was made in the usual manner. Engineer Hein on the 1837, after the change was made, again called for the passing track but he could not see whether he got it or not as the electric headlight on No. 1's engine blinded him to such an extent that he could not see the semaphore signal. He sent the brakeman down to tell No. 1's engineer to put out the light; before the brakeman reached the depot, however, Engineer West on No. 1 thought possibly that the trouble was on account of Engineer Hein not being able to see the signal on account of his headlight, and he put it out, after which extra 1837 pulled into clear.

CONSULTING ENGINEER MAX TOLTZ'S REPORT.

A test was made on February 21 at the Dale street shops of the Great Northern Railway, in charge of Dr. Chamberlin and the undersigned, for the purpose of establishing the advantages or disadvantages of the electric headlight.

Dr. Chamberlin, whose report deals with the effect of the light upon the eye, has given the details of the conduction of the test and its result.

The undersigned, having had to investigate the different types of headlights, not alone from the mechanical, but more so from the operating standpoint, for the last ten years, begs to report as follows:

After about two hours of the beginning of the test the distinction of colored signal lights was confused so much so that the six observers could not distinguish a red light, four of them declaring it yellow and two of them white. The green lights were picked out as yellow and the blue lights as the hazy white.

From the foregoing test it can be seen that by the use of an electric headlight the safety of trains is endangered, which fact has long been established, especially by the Baltimore &

Ohio Railroad, which, after using such electrical headlights for several years, abandoned them two years ago. It was found that enginemen could not distinguish colored signals readily, and the trainmen working in yards were hampered in carrying out their duties, due to the glaring light approaching them. They generally sought a place of safety until the locomotive carrying an electric light passed. Worse conditions were had when two trains, each having electric headlight, were approaching each other on adjoining tracks, especially in yards, because none of the enginemen or firemen were able to observe colored signals safely.

The test conducted simply confirms the above statement.

In the New England states there exists a law that electric railways, especially in the country, must throw a curtain in front of their electric headlights when approaching teams or automobiles.

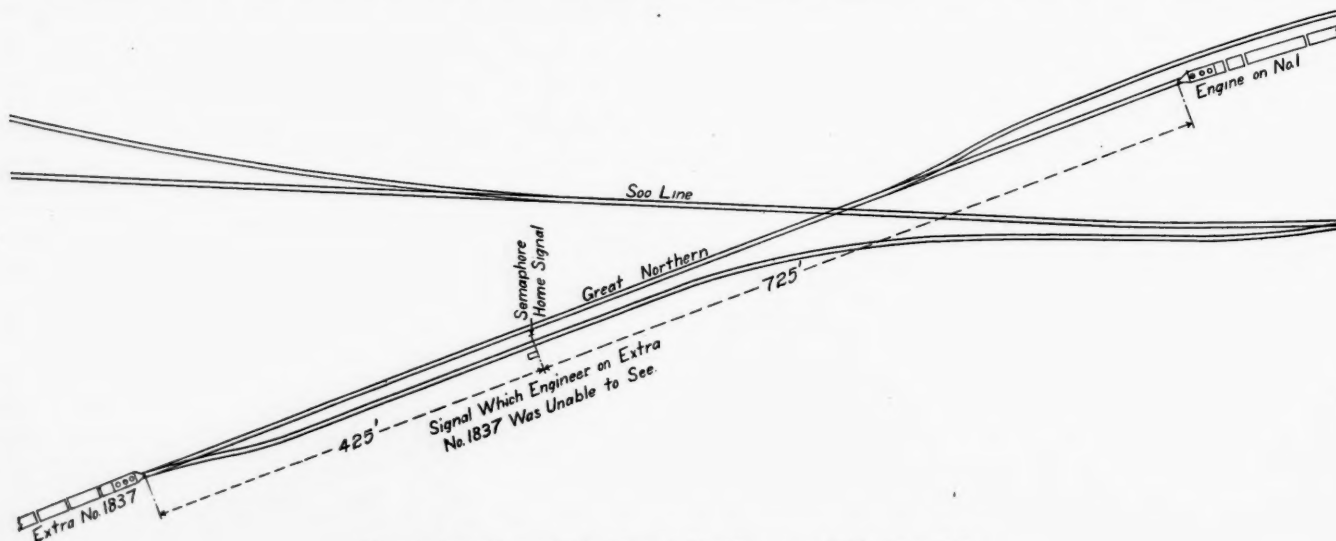
The undersigned had also experience with searchlights, especially for marine purposes, and begs to call attention to the fact that in a mist or fog the electric searchlight has a considerably smaller penetration than a light thrown by an oil lamp strengthened by a parabolic reflector. In his 26 years of railway experience as mechanical and operating official, the undersigned has found that most of the enginemen who have traveled back of an electric headlight have expressed

area at the farther end of the room, which was brilliantly lighted by its rays.

At the end of half an hour another electric headlight, which had been installed in the opposite end of the room, was turned on and its rays directed toward the observers of the experiment to simulate the light as it is thrown in the eyes of an engine crew when two trains meet or pass on parallel tracks. This second light was continued for ten seconds, when the experiment proceeded as before, being interrupted at the end of each half hour by the second light as before detailed.

At the end of two hours the various colored lights were exhibited in the field illuminated by the first described headlight, and each observer was requested to write upon a card the name of the color as he saw it. After the colors had been exhibited several times under the illumination of the electric headlight, at 600 ft. distance, the same lights were exhibited in the same rotation, without the electric illumination, so that each observer might have an opportunity to verify or correct his former reading, and he was requested to write the name of the colors as they appeared to him on the second card, for purposes of comparison.

After looking in the direction of the light projected from the electric headlight for a space of two hours their color



Minot Junction of the Great Northern and the Soo Line.

themselves in favor of a light of the color and intensity of an oil headlight for the reason that such light is not alone easier on the eyes but gives enough penetration and the best safety regarding the distinguishing of colored signals.

The conclusion drawn from the test, as well as from the experience of other railways and from that of the undersigned is: "The use of electric headlights on any road should be discontinued at once on account of the danger of conducting transportation safely."

DR. J. W. CHAMBERLIN'S REPORT.

The demonstration on February 24 was conducted in a room in the Great Northern shops, where there was a space 600 ft. in length available and covered a period of over four hours.

A large electric headlight was mounted at one end of the room and the light from it was projected to the other end. Fifteen observers who assisted in making the experiments were seated behind the light where they could look in the direction of its rays. A standard signal lamp was mounted at the other end of the room and arranged so that the colors ordinarily used for signaling on railways could be exhibited, one at a time. The colors used were red, white, green, yellow and blue.

With the observers comfortably seated the experiments began at 7:30. The electric headlight was turned on and the observers were instructed to direct their attention to the

sense was so dulled as to make it absolutely unreliable in the perception of colors. A comparison of the reports written by the different observers on the two cards above described indicate that in every instance there were mistakes made in naming the colors.

Of the 15 observers who recorded their observation eight of them miscalled red at its first exhibition, one at its second exhibition, three at its third exhibition, 12 at its fourth exhibition. [Twenty-four similar tests with four colors showed a like proportion of errors by the observers.]

Thus it will be seen that the effect of this experiment upon the eyes of the observers was to render them incapable of exercising a sufficient amount of color sense to make them safe in the interpretation of signals.

After the first two hours and a half nearly all the colors exhibited had the appearance of being grayish white and all looked very much alike.

It is perhaps too early to foretell what the ultimate effect would be upon the eyes of men who are obliged to look into these lights for a number of hours each day, but it would seem that in time the over-stimulation of the color sense, which renders it inoperative, might produce permanent results, and that men who are obliged to gaze for hours into this brilliantly lighted area might permanently lose their color sense.

EDWARD H. HARRIMAN.

Edward Henry Harriman was born in Hempstead, L. I., February 25, 1848, and died at Arden, N. Y., September 9, 1909. His father was an Episcopal clergyman, who, about a year after his son's birth, lost his church at Hempstead and moved to Jersey City, living there in great poverty. Harriman had a public school education, and when about 14 began work as a clerk in a broker's office in New York City. In 1870, when he was 22, he bought a seat on the New York Stock Exchange, doubtless with the help of certain well-to-do relatives. He became at once a floor trader—that is, a speculator on his own account—and in 1872 became head of the firm of Harriman & Co. Nicholas Fish, a brother of Stuyvesant Fish, was a special partner of the firm, which did a considerable brokerage business for the Vanderbilts.

In 1883 Mr. Harriman was elected a director in the Illinois Central through the friendship of Stuyvesant Fish, then vice-president. In 1884 Mr. Fish became president, and in 1887 Mr. Harriman was elected vice-president. It was through his connection with the Illinois Central that he became well acquainted with Kuhn, Loeb & Co., and it was through these bankers that the syndicate was formed, which included James Stillman, of the National City Bank, and acquired control of the Union Pacific when it was reorganized in 1898. At that time the road was in wretched condition, physically, and entirely without traffic relations by which it could compel favorable exchanges of freight either at its eastern end at Omaha, or at Ogden on the west.

From the time Mr. Harriman entered the board of directors the two objects that the Union Pacific was constantly striving for were physical betterment of the property and the acquisition of other lines which would give it a commanding position in the bid for through traffic. At first it was proposed to merge the Union Pacific with the Chicago and North-Western and the New York Central lines, but the Vanderbilts would have nothing to do with this, and Mr. Harriman, with the aid of Kuhn, Loeb & Co. and the help and friendship of James Hazen Hyde, vice-president of the Equitable Life, succeeded in raising the money necessary to partially rebuild the Union Pacific. More securities were issued and control of the Oregon Short Line was acquired, giving an indispensable western stronghold to the system. It is noteworthy that Charles E. Perkins, president of the Chicago, Burlington & Quincy until February, 1901, had long recognized the tremendous strategic importance of the Short Line, and had labored with his Boston directors to induce them to take it at a time when it could have been had almost for nothing. But the Boston directors were afraid, and they felt their trusteeship so burdensome that they were unwilling to take the risk. Had they

followed the advice of their president the history of the Union Pacific would have read very differently—a fact which was clearly understood both by Mr. Harriman and Mr. Perkins.

Mr. Harriman obtained control of the Chicago & Alton in 1899 through a syndicate, the other leading members of which were George J. Gould, James Stillman and Kuhn, Loeb & Co. At that time the Alton had behind it a long record of conservative, profitable management under T. P. Blackstone, who had been president since 1864. But it was in need of heavy new expenditures and a thorough plan of modernizing; it operated in highly competitive territory, and its finances were so managed that it lacked, of its own resources, the broad credit needed for rehabilitation. The syndicate reorganized the road and recapitalized it, putting out large amounts of new securities against construction work done many years before—

work which Mr. Blackstone had always intended to fund when opportunity should arise. Then the 3 per cent. bonds used in the recapitalization to retire the existing 6 per cent. and 7 per cent. bonds and to provide additional funds were issued to the syndicate (and to all other shareholders alike) at 65, a 4½ per cent. basis, and the syndicate subsequently marketed its holding with the Equitable Life Insurance Company at 90.

Mr. Harriman received a tremendous amount of criticism on account of these transactions, first because of the capitalization of the old betterment work, and then because of the fact that the bonds bought by the syndicate at 65 were promptly sold by it at 90. Though not in accordance with the best practice, the restoration to the owners of the road of the sums previously spent in betterments was clearly admissible accounting, with ample precedent, and it damaged no one. The 3 per cent. bond issue was offered to all shareholders alike at 65; that the syndicate was able to dispose of the holdings of its shareholders at



Edward H. Harriman.

90 reflected much more on the Equitable Life Insurance Company than on the syndicate, which was fairly entitled to any profit it could get. Yet, viewed in the light of subsequent developments, the entire transaction was unfortunate. The originators overreached themselves and left themselves a target for the furious political attack which followed. At the time when the details of the Alton refinancing were arranged Mr. Harriman was in Alaska on a trip to the Muir glacier. To what extent the plan was originated by him can only be a matter of conjecture, but it is obvious that other hands carried it out. It is also obvious that he made no effort to avoid full personal responsibility.

Collis P. Huntington, president of the Southern Pacific and the Central Pacific, died in 1900. By February, 1901, the Union Pacific had acquired control of the Southern Pacific. This was accomplished by means of an issue of \$100,000,000 convertible bonds, of which about \$40,000,000 were needed to

effect the purchase. Mr. Harriman then sought an independent entrance into Chicago. Failing in his effort to obtain control, and subsequently to obtain a half interest in the Burlington by direct purchase, Mr. Harriman sought to accomplish this indirectly, by buying the Northern Pacific, joint holder with the Great Northern, of the entire stock of the Chicago, Burlington & Quincy Railway, which leases the Chicago, Burlington & Quincy Railroad. Mr. Harriman quietly secured a control, based on a majority of the total stock, common and preferred, of the Northern Pacific. Mr. Hill perhaps doubted this control, or perhaps calculated on use of the privilege which the company had of retiring its preferred stock for cash. At all events, he started buying Northern Pacific in the open market in May, 1901, without limiting the price his brokers were to pay.

As Northern Pacific scared, the shorts sold it heavily and disposed of considerably more stock than could be covered, the price rising above \$1,000 per share during their efforts. In order to avert a panic, arrangements were then made by which the shorts could save their commercial lives. Owing to the clause permitting Northern Pacific preferred stock to be retired for cash, and the legal uncertainty as to the right of preferred stockholders to vote on this proposition beforehand, a compromise was eventually effected between the Hill and Harriman interests, resulting in the formation of the Northern Securities Company, which issued its own certificates in place of the Great Northern, Northern Pacific and Chicago, Burlington & Quincy Railway stock deposited with it. The dissolution of this company by the courts is familiar history, as is the fact that Mr. Hill was upheld in his contention that the assets were to be distributed *pro rata*, so that Mr. Harriman, who went into the combination with the majority stock of one road, came out with a minority representation in all three.

In August, 1906, Union Pacific dividends were raised from a 6 per cent. to a 10 per cent. basis, and the Southern Pacific, which never had paid a dividend, was put on a 5 per cent. basis (subsequently raised to 6). These sensational increases created a great deal of unfavorable comment at the time, although they were amply justified by the earnings of the companies. But hostile criticism was especially directed at the lapse of time between the meeting of the executive committee and the announcement of the dividend. Mr. Harriman never made the slightest effort to clear himself of the charge of having taken enormous profits by reason of delay. Yet, as a matter of fact, he was absent from the city at the time of the meeting, attending the funeral of a relative, and the delay was really a rather comic instance of the awe which Mr. Harriman inspired among his associates, who simply did not dare make the announcement in his absence. The records of the New York Stock Exchange fail to show any extraordinary purchases of Union and Southern Pacific during the interval between the declaration of the dividends and the public announcement, and it seems reasonably certain that a financier as astute as Mr. Harriman, fully informed about the road's earnings and the dividend probabilities, would have chosen in preference almost any other days in the year in which to do his buying. Mr. Harriman's closest friends do not believe that he made a dollar by his *coup*, during the days of suspense.

In 1907, after a bitter fight, Mr. Harriman ousted Stuyvesant Fish from the Illinois Central, elected J. T. Harahan president and obtained at once his Chicago connection and a fine water grade to the Gulf, connecting the Union Pacific with Chicago and Chicago with the Southern Pacific. In 1908 he obtained control of the Central of Georgia and perfected its connections with the Illinois Central, so that he had his own rails from the Atlantic coast at Savannah to the Pacific at Los Angeles, San Francisco and Portland. Less than a year before his death he was elected a director of the New York Central and its affiliated lines, and at the time when he saved the Erie from receivership, in 1908, he presumably obtained a considerable amount of authority in its management. He was also

influential in the affairs of the Delaware & Hudson and the Kansas City Southern, while on the other side of the continent he owned a half share in the San Pedro, Los Angeles & Salt Lake. He was a director in the Baltimore & Ohio and the Pere Marquette, and if his participation in the affairs of such controlled properties as the Reading, Hocking Valley and Cincinnati, Hamilton & Dayton be included, he had direct authority in the management of over 50,000 miles of railway.

THE HUDSON AND MANHATTAN TUNNEL SYSTEM.

BY J. VIPOND DAVIES.

It is a curious coincidence that within a few months of the celebration of the Tercentenary of the discovery of the Hudson river by Henry Hudson there should also be celebrated the construction and placing in service of the first direct physical connection beneath the waters of the Hudson river between the states of New York and New Jersey.

The development of the city of New York, for the most part upon a group of islands bunched at the mouth of the Hudson river and separated in every direction from the mainland, has in the past and until the current year been cut off from connection with the mainland of the United States excepting by means of transportation by ferryboat, or to the north across the Harlem river. The railway entry into the city from the north and from the entire western portion of the United States has heretofore been limited to connection by the New York Central & Hudson River and its tributary lines, and even the West Shore Railroad, which comes under the same ownership, has of necessity terminated on the westerly shore of the Hudson river, and there has in consequence of the geographical conditions surrounding New York grown up on the westerly shore of the Hudson river in the state of New Jersey a great assemblage of all the trunk lines handling business in and out of New York city, with ferryboats the only means of communication afforded.

The Hudson river, for the length of Manhattan island, is practically a mile wide, but north of Hoboken the palisades on the New Jersey side of the river reduce the width of *fore* shore fronting the river to an exceedingly narrow area. The consequence of this geographical situation is that all the trunk lines have become grouped on the Hoboken and Jersey City shores with the one exception of the West Shore terminating at Weehawken, which railway also has connection for passenger trains into the Pennsylvania Railroad station in Jersey City, so that to all intents and purposes communication by all these trunk line railways is within the district forming Hoboken and Jersey City. The development of this Jersey City water front has been by these terminal railways who acquired the riparian rights to lands under the water and filled in and extended the lands under water, thus forming the yards and terminals of these railways, precisely in the same manner that to-day the Central Railroad of New Jersey and the Pennsylvania Railroad are reclaiming and developing lands under water in the Communipaw and Greenville districts of Jersey City.

The railways terminating in Hoboken and Jersey City are as follows:

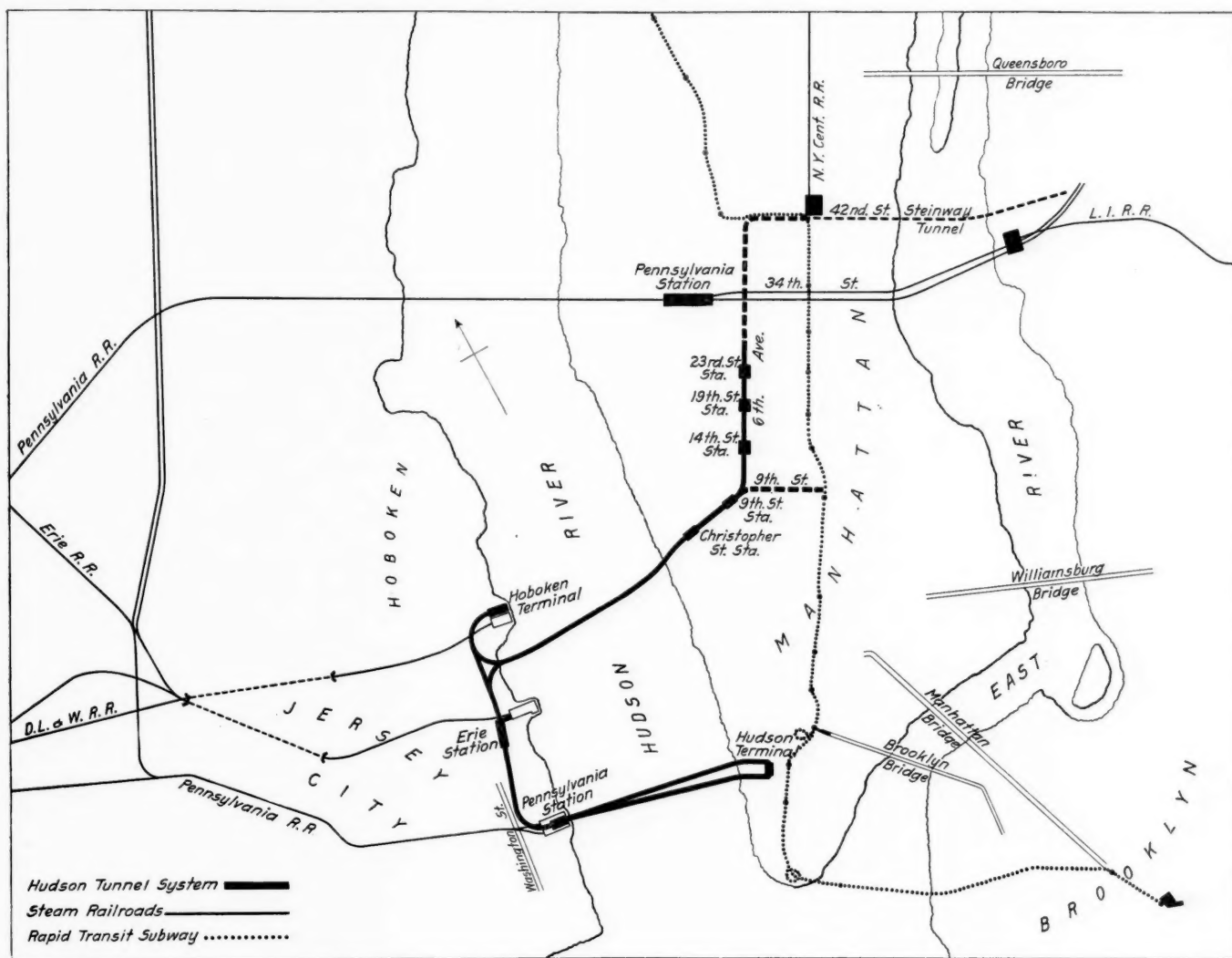
- Delaware, Lackawanna & Western at Hoboken;
- Erie Railroad, with its subsidiary lines, immediately south thereof in the vicinity of Pavonia avenue, Jersey City;
- Pennsylvania Railroad, with its tributary and subsidiary lines, south of the Erie Railroad, and approximately at Exchange place, Jersey City. Entering over the tracks of the Pennsylvania Railroad are the New York, Susquehanna & Western, the Lehigh Valley, and the West Shore.
- Central Railroad of New Jersey has its passenger terminal south of the Pennsylvania Railroad in Communipaw (Jersey City), but owing to the existence of the Morris Canal inlet, this location is practically cut off from street connection with Jersey City proper excepting by the long thoroughfare known as Johnston avenue, extending to the west. Passenger trains of the Baltimore & Ohio and the Philadelphia & Reading also enter the terminal station of the Central Railroad of New Jersey.

It is evident from the topography of the New Jersey shore

above referred to that north of Hoboken the close proximity of the palisades to the short front makes it inconvenient for any tunnel for railway connection landing near the water front to be constructed, since to make connection with any lines of railway it would be necessary to pass through the palisades to obtain a physical grade connection. This is the condition which has been met by the Pennsylvania Railroad with its tunnels and which was essential to that connection. Consequently, for local transportation it is necessary to locate any tunnel connection across the Hudson river at points either in Hoboken or in Jersey City. This frontage on the opposite New York side embraces the entire business districts of Manhattan island.

In addition to the steam railways, which control all the ferryboats operated across the Hudson river between New

posed practically of a narrow strip fronting on the Hudson river, the bulk of its population being in Jersey City and Hoboken, and in the past this population has had no means of intercommunication with New York City excepting by the ferryboats having terminals at Weehawken, at Fourteenth street, Hoboken; at Hudson place, Hoboken; at Pavonia avenue, Jersey City, and at Exchange place, Jersey City. It is, therefore, obvious that apart altogether from through railway business terminating on the various trunk railways aforementioned, there has been, and is now, a tremendous demand for more rapid communication for the great population in the suburban district of New Jersey tributary to New York. Close estimates have been made of the ferry traffic across the Hudson river, and conservative counts indicate that it is not less than 125,000,000 per year, and with the increased facilities



Hudson & Manhattan Tunnel System.

Jersey and New York, there are tributary to the ferries the various trolley car lines of the Public Service Corporation of New Jersey, feeding from the entire suburban district of New Jersey.

The geographical situation of New York City really makes the City Hall the center of an immensely populous territory forming the metropolitan district, whether on Long Island, Manhattan island, the Bronx, Staten Island or within the state of New Jersey, all being tributary to New York City. In the latter portion of this metropolitan district are embraced the counties of Hudson, Bergen, Essex and Union, representing a population of more than a million people directly tributary to New York City and largely transacting their daily business in New York City. In Hudson county alone there is a population of some 438,000 persons, and this county is com-

afforded by the tunnels it is thought that the annual increase in this traffic will be much greater than is indicated by the ferry traffic in the past.

The suburban district of New Jersey for residential purposes is at least as beautiful and as attractive in every respect as any section of country surrounding New York City, and to the commuting population the attractiveness of any locality as a place of residence is largely governed by its accessibility measured by the factor of time required in travel between the home and the place of business.

About the year 1873, the Hudson River Tunnel Company was organized by DeWitt Clinton Haskins with capital largely advanced by Trenor Park, to carry out the project put forward by Col. Haskins to tunnel the Hudson river for the purpose of connecting New Jersey and New York. At that time the

center of the fashionable residential district of New York City was located at Washington Square and the two railways then, as now, doing the largest suburban business were the Delaware, Lackawanna & Western and the Erie. Col. Haskins consequently located the line of the tunnel in Jersey City at the foot of Fifteenth street, this point being approximately midway between the terminals of the Lackawanna and the Erie, and the idea as projected by him was to extend under the streets partly, but largely under private property in a direct line to a terminal station to be located on private property in the vicinity of Washington Square. The entire plan was predicated on the assumption that the steam trains of the Lackawanna and the Erie would operate through this tunnel directly into a union station in the neighborhood of Washington Square. This plan left out of consideration the Pennsylvania and all other railways terminating in Jersey City, and with our present knowledge of the conditions of operation, it is certain that even had these tunnels been constructed at that time the use of the same by steam trains would have been an impossibility, and the tunnels would probably have had to await the development of other motive power than steam before they could have been operated successfully for passenger traffic. During the subsequent long period of troubles and reorganizations through which the companies passed, there developed complete changes in the operating conditions, not only in New York City, but also in Jersey City and Hoboken, and at the time of the last reorganization and the formation of the present company it had become necessary to change entirely the proposed scheme of operation of these tunnels to meet the new conditions which had arisen in respect to transportation. The original location of the so-called Uptown Tunnels from Fifteenth street, Jersey City, to the foot of Morton street, New York, was by no means ideal for the uptown business, and in no respect whatever was the location serviceable for handling the downtown business. At the time of the last reorganization of the tunnel company it was essential that the possibility of constructing a tunnel across the river should be demonstrated before anything else could be done, and it was, therefore, necessary to concentrate work on one tube to make a connection from shore to shore. The numerous difficulties and obstacles with which the previous companies and contractors had been met had left the work in a condition which made the general public extremely doubtful as to whether or not this could ever be accomplished, and it was fully convinced that the project could not be carried out to successful completion. The work in Jersey City had originally been commenced with the idea of constructing one large tunnel sufficiently large for double tracks, but before any considerable portion of the tunnel had been constructed under the earlier methods it was demonstrated clearly that the difficulties to be encountered in the endeavor to construct a gigantic tunnel for two standard steam railway tracks were so great that this idea was early abandoned and the twin tunnels were commenced. The work executed by Col. Haskins was done under air pressure, the tunnel lining consisting in the first instance of an external shell of thin sheet-iron plates, 2½ ft. wide, ¼ in. thick, in small segments connected by 3-in. angle irons, which could be put together by hand, and the segments were braced for the support of the soil outside. On the completion of a section of excavation in this manner the internal brick lining was constructed, having a finished internal section oval in form 16 ft. wide and 18 ft. high.

This type of construction was carried on in the southerly tube from Jersey City a distance of some 500 ft. and in the northerly tube a distance of approximately 2,000 ft. Neither the alignment nor grade could be maintained correctly, and a good deal of the portions so constructed had exceedingly bad curvature. After suspension of the work carried on by Col. Haskins, work was resumed under contract by using a shield and iron plate lining, this lining having an internal diameter of 18 ft. 2 in., circular in section. At the time of the last re-

organization the work had been constructed to the following extent:

North tunnel from New Jersey shaft.....	3,916 ft.
North tunnel from New York shaft.....	160 ft.
South tunnel from New Jersey shaft.....	570 ft.

At the time of the suspension of work last mentioned the shield had advanced to a point where there existed immediately in front of it in the north tunnel a reef of rock which extends all along the shore of Manhattan island in the downtown section. When the reorganization was effected by the New York & New Jersey Railway Company (now the Hudson & Manhattan Railroad Company), the work was resumed by the Hudson Improvement Company, in order to demonstrate, as before mentioned, the feasibility of building a tunnel under the river from shore to shore.

All work was concentrated on completing the northerly tube by the use of the shield and iron lining plates 18 ft. 2 in. in diameter, with the idea of constructing a double track railway in one tunnel with specially designed narrow equipment, similar to the tubes first built in London, and to operate these small cars by electric power. This tunnel was completed from Jersey City to New York on March 11, 1904. As the work proceeded satisfactorily, questions of the general development of the project arose, and it became obvious that if the tunnel were to be successful for operation of passenger traffic it should be operated with equipment of about similar size to that in general use, and consequently it was decided that a single tube with the special type of narrow equipment would not be at all satisfactory. Work was, therefore, resumed on the second parallel tube, adopting a size which would enable a car of satisfactory dimensions to be operated through the same, determined as 15 ft. 3 in. internal diameter. At the same time the undesirable terminal location in Jersey City, originally contemplated, was abandoned, and it was then decided to relocate the line to extend northerly under the Lackawanna company's property to Hoboken with a terminal at the foot of Hudson Place, where the terminal of the Lackawanna as well as the terminals of the trolley cars of the Public Service Corporation of New Jersey are located; this location furnishing a definite source of business to accrue to the tunnels. Satisfactory and amicable arrangements were made with the Public Service Corporation for a terminal beneath its property, a part of which, however, is beneath the streets of Hoboken, the rights to the use of which were provided by the franchises. At the same time the Erie desired to be considered in relation to this means of transportation under the river between Jersey City and New York, and in consequence lines were filed for a location extending also southerly to the Erie, and, to complete the operating proposition, lines were extended to connect Hoboken with the Erie. As this project developed it became evident that while provision was being made for uptown business no provision whatsoever was being made in this scheme for any downtown business, and, further, that the uptown terminal at Christopher and Greenwich streets was inadequate to care for or to benefit the traveling public desiring access to the business centers in New York City. Application was, therefore, made to the Board of Rapid Transit Commissioners for a franchise to change the New York terminal by extending the tunnels in New York City, from the terminal above mentioned, under Christopher street and Sixth avenue to a terminal under private property at Thirty-third street and Broadway, and while this application was pending influence was brought to bear to change this terminal to a point at Fourth avenue and Ninth street. The franchise granted by the Board of Rapid Transit Railway Commissioners ultimately provided for the two terminals—one at Thirty-third street and Broadway and one at Fourth avenue and Ninth street; these two terminals affording connection with the Interborough Rapid Transit subway and with the surface and elevated lines

in the shopping district in Sixth avenue, and active work proceeded on the construction of these several lines.

The routes and terminals above mentioned would, when constructed, provide admirable facilities for passengers between the Erie and the Lackawanna and uptown New York, but no provision had thus far been made for the much heavier business coming daily into the downtown district, and which involved a larger proportion of the commuting business between New York City and the suburbs. To plan a line to the downtown district the first essential was to locate a site on which to construct a terminal, and as at this time the Pennsylvania had commenced work on its extension into New York City, uptown, the company was desirous of co-operating in any project which would give rapid transit to the downtown district for its patrons, and the line for the downtown tunnels of the Hudson & Manhattan was finally located from the Pennsylvania station in Jersey City to a terminal on private property fronting on Church street and extending from Cortlandt street to Fulton street in New York City. This terminal was constructed with a series of five loop tracks, trains entering at the Cortlandt street end and departing at the Fulton street end, thus obviating stub end terminal operation. These downtown tunnels were located with the idea not only of a station under the trainshed of the Pennsylvania Railroad in Jersey City, but with a view of making a physical connection with the Pennsylvania tracks to the west. A connection between the uptown system and the downtown system completed the project as now carried out in actual fact. The system as now operating connects, therefore, the main trunk lines terminating in New Jersey, excepting the Central Railroad of New Jersey, with both the uptown and downtown districts of New York City, and the Central Railroad of New Jersey will also in the future be taken care of.

In respect to the physical connection with the Pennsylvania Railroad, such as before mentioned, this cannot be completed until after the Pennsylvania changes its terminal for through traffic from Jersey City to its new station in New York City, at Seventh avenue and Thirty-third street, after which the lines of the Hudson & Manhattan will extend to the surface in Jersey City and connect with the tracks of the Pennsylvania.

Within the current year it has been considered desirable, in order to make the system complete, to extend the uptown tunnels beyond the proposed point of terminus at Thirty-third street and Broadway, northerly under Sixth avenue to Forty-second street, thence to the Grand Central Station, where the terminal station of the Hudson & Manhattan will be in immediate contiguity, not only with the Grand Central Station, which is now being constructed as a depressed station, but also with the express station of the Interborough Rapid Transit subway. This terminal of the Hudson & Manhattan will be approximately at the same level as the suburban station of the New York Central & Hudson River, and this will consequently permit of a very satisfactory transfer connection for passengers between the two terminals. This complete plan will make a connection between the New York Central and the New Haven and all the railways before mentioned terminating in New Jersey. Besides this, the station at Thirty-third street and Sixth avenue will be only a block from the Pennsylvania and the Long Island Railroad.

Actual count of passengers handled on the ferries between New York and New Jersey indicates that the maximum hour of travel in one direction is westbound between 5 and 6 p. m., during which period the percentage of travel is 10.69 of the entire daily movement. The travel eastbound reaches the maximum between 7 and 8 a. m., when 7.49 per cent. of the entire day's traffic is handled. These percentages are constant factors in determining the maximum conditions regulating traffic operation. The tunnels are constructed of size suitable for operation of the usual type of suburban car and for operation of multiple unit trains of eight cars on a mini-

mum headway of $1\frac{1}{2}$ minutes. Figured on the percentages, there is provision for future development of transportation on the company's lines between New York and New Jersey considerably beyond the entire present passenger movement in addition to the heavy local business accruing from local traffic on both sides of the river. The passenger traffic reaching the ferries on the New Jersey side by trolley cars is approximately 150,000 per day in both directions, and the bulk of this travel is from points at some distance from the ferries, where the tunnel stations will be of direct benefit. At the Jersey City ferries of the Pennsylvania Railroad the morning and evening congestion of the trolley car service is very great; so much so that from the residential district on Jersey heights the average time of travel on trolley cars to reach those ferries at Jersey City is 20 minutes. This district will be immediately served by the tunnel station at Summit avenue, from which the running time of trains to the Church street terminal, New York City, will be 10 minutes. As no ferry across the Hudson River at the present time operates in less than $7\frac{1}{2}$ minutes interval, and the bulk of the ferries in not less than 10 minutes, and the tunnel trains now operate at 3 minutes interval and will ultimately operate on $1\frac{1}{2}$ minutes, the saving in time to the local population of Jersey City and Hoboken, apart altogether from the railway traffic, is very obvious. The difference is still more marked for all traffic into the uptown district, and it is safe to say that for railway passengers terminating at the several points on the Jersey side destined to the downtown district in New York City, using the river tunnels, the saving in time will be 15 minutes in each direction, and to passengers to the uptown district the saving will be in each direction from 20 to 30 minutes.

ORGANIZATION AND WORK PLANTS.

About the year 1902, when the organization of the present company was effected, it was desired to let contracts for the construction of the uptown tunnel between Jersey City and New York, and tenders were invited from numerous contractors for this work to be constructed to specification requirements. In response to all the invitations there was only one bid, which was by no means satisfactory to the company, and it was then decided to carry out all the work with the company's own forces. At that time the construction and equipment of the entire system as then planned was to be executed by the Hudson Improvement Company, which company has since been merged into the Hudson Companies, and the latter has carried out to completion the entire system now in operation by the Hudson & Manhattan Railroad Company. With the exception of the subway portion of the Sixth avenue extension all work has been executed directly by the company's own employees under the direction and management of the company's engineers, and this arrangement has proved eminently satisfactory, particularly as the largest portion of the work has been executed under air pressure involving all the difficulties and dangers of such work, and the company has in consequence had under better control all questions relating to the possibility of injuries which might have occurred, and it is a matter of great pride that in the execution of the work along the lines now completed and in operation there has been an almost entire absence of fatal injury from air pressure work, or caisson disease, and very few injuries of moment to employees from any other causes.

The work recently completed involved the construction of some 12.6 miles of track almost the whole of which is in single track tunnel. With the exception of the portion of the Sixth avenue extension the whole of the work is below mean sea level. This includes the construction work on the various stations, which will be referred to later.

A great added advantage in carrying out the work with the company's own organization is the obvious fact that the work could proceed without designing and planning all the details in advance. This was of enormous advantage, as the conditions changed so frequently during the execution of the work

that to have carried out the construction by contract under the conditions would have involved the company in constant difficulties with the contractors, owing to the changes, not only in the details, but in matters of policy and of importance. Therefore, the arrangement for carrying out the work with the company's own forces was most elastic and conducted most thoroughly to the rapid and efficient execution of the work, and as the operating, electrical and construction departments were all under one head the co-operation was complete and the co-ordination of all interests was most effective.

As this entire work involved underground construction, except at isolated points, the construction could only be carried on from a limited number of places designated "Work Plants," at each of which points a complete power plant was installed. These plants were located as follows:

1. At the foot of Fifteenth street, Jersey City, at which point the original shaft, commenced by Colonel Haskins, was located. This plant consisted of a steel frame building covered with sheet metal, and contained a boiler plant of 1,800 h.p. boiler capacity, high and low pressure air compressors, hydraulic pumps operated to 5,000 lbs. pressure with an accumulator loaded to 1,500 lbs. pressure, generating plant for 250-volt direct current, medical lock and doctor's office, bath room, locker room and dressing room for workmen and various offices. This plant was fortunately located in the yards of the Delaware, Lackawanna & Western, where deliveries of materials were made on tracks alongside the works, and by lease from the D. L. & W. the company was enabled to dump excavated material from the tunnels into scows at the bulkhead adjacent to the works for disposal at sea. From this plant the two uptown river tunnels were constructed toward and for the entire distance to New York, the two tunnels west and north toward Hoboken, the two tunnels west and south toward the Erie Railroad, and also caissons Nos. 1, 2 and 3, hereinafter referred to.

2. At Hoboken. At this point the terminal station was constructed in open excavation, but on account of the necessity of expediting the completion of the Hoboken tunnels a subsidiary plant was installed and the two tunnels from Hoboken Terminal west and south to join the river tunnels were also constructed with shields, in the same manner as the tunnels were constructed from the Fifteenth street plant.

3. Foot of Morton street, New York. This plant was constructed on the property of the Department of Docks and Ferries exterior to West street at the site of the original work commenced by Colonel Haskins and where a shaft had at that time been constructed in caisson. This plant consisted of a steel frame building covered with sheet metal and contained boilers of 1,200 h.p. boiler capacity, high and low pressure air compressors, and other equipment, generally similar to the plant at Fifteenth street shaft above mentioned.

From the Morton street plant two tunnels were constructed eastward under West street, thence by a reverse curve into and under Morton street, thence curving to the left into and under Greenwich street, thence northerly under Greenwich street to Christopher street, thence curving to the left into and under Christopher street, thence easterly under Christopher street into and under Sixth avenue, thence northerly under Sixth avenue to Twelfth street. The shield in the eastbound tunnel turned from Sixth avenue into Ninth street and extended under Ninth street clear of the line of Sixth avenue, and a shield installed at the intersection of Sixth avenue and Ninth street executed the work northerly from that point to Twelfth street. The shield in the westbound tunnel continued to Twelfth street, where it passed out into open cut constructed subway. No tunnels were constructed westerly from Morton street plant. The location of this plant permitted the receipt of materials and the disposal of excavated material by boat or lighter over the bulkhead at the water front at the head of the French Line dock.

4. At Ninth street and Sixth avenue, New York. This plant

was erected on private property with the expectation of proceeding immediately with the work under Ninth street, and was used for the junction enlargement and for other work on Sixth avenue in that immediate vicinity, but this was only a subsidiary plant in connection with the plant at Morton street, and was equipped with high-pressure air compressors and had 370-h.p. boiler capacity, besides dressing rooms, lockers, etc.

5. Washington street plant. This plant was located on Washington street, between Bay and First streets, Jersey City, immediately adjoining the permanent power house of the company erected at that point. This plant contained 1,200-h.p. boiler capacity, water-tube boilers, a modern and efficient air compressor plant for high and low pressure air, with all the other arrangements installed at the several plants. This location was selected as being about the center of gravity of the system. The shaft was sunk in the center of Washington street to the grade of the two tunnels and work was carried on in each tunnel, towards both the north and south, from this plant, the southerly legs bifurcating to connect westerly to the Newark line over the Pennsylvania tracks and easterly to Church street terminal, New York. In addition to the regular tunnel work constructed from this plant, the intake and overflow tunnels for the power house were constructed, as well as the foundation work for the permanent power house. This location was served by the yard tracks of the Pennsylvania Railroad entering on to the property.

6. Pier C plant. This plant is located at the foot of York street, between Piers B and C, Jersey City. As the lines of the downtown tunnels were located under the trainshed of the Pennsylvania Railroad, in order to execute all construction work at this point it was necessary to locate the point of attack at considerable distance from the actual tunnels. To do this the company leased from the Pennsylvania Railroad a piece of property south of York street at the water front, together with a portion of the bulkhead and Pier C. The shaft was constructed by sinking in the water at the head of the dock an iron shell into the mud and through the mud to bedrock, and then, after sealing the shaft to the rock, a shaft in the rock was excavated to a depth of approximately 90 ft. below the surface. From the bottom of this shaft a heading was driven northerly a distance of some 300 ft., in which was installed a three-track narrow gage railway on which cars loaded with excavated material from the tunnels and supplies going into the work were hauled by an electrical mining locomotive with overhead trolley. From this heading the two river tunnels towards New York were driven, the enlargements for the Pennsylvania station and the five tunnels west of the Pennsylvania station were constructed. Of the five tracks west just referred to, Nos. 1 and 5 are direct connections to and from Hoboken, Nos. 2 and 4 direct connections to and from Newark, and No. 3 is a stub-end crossover track. This plant was equipped with 1,800-h.p. boiler capacity, high and low pressure air compressors, hydraulic pumps and electrical generators generally similar to the other principal plants.

7. Dey street, New York. This plant included also a separate and distinct plant put in for the construction of the caissons and foundations of the Church street terminal station and buildings, but for the construction of the approaches and the tunnels from the New York side a plant was installed in the cellars, or basements, of a number of adjacent buildings owned by the company, or leased, and made a very necessary but most expensive plant to operate. This plant contained 1,775-h.p. boiler capacity, with the usual compressors, hydraulic machinery, locker and dressing rooms, medical lock, doctors' quarters, etc. In addition to this steam power was also drawn at times from an outside concern furnishing steam commercially, and during the latter portions of the work, the terminal building being completed prior to the completion of the tunnels, the boiler plant installed in the building was drawn upon quite largely for power.

8. For the execution of the Railroad avenue work in Jer-

sey City a small subsidiary plant was installed on Railroad avenue near Warren street. This plant is equipped with compressors, etc., operated electrically by current from the plant at Pier C.

To indicate the magnitude of the work carried on from these various plants it should be noted that for the work of construction, since 1902, there was consumed 240,000 tons of coal, and from the commencement of construction work in February, 1902, to the completion of air pressure work on June 26, 1909, the air compressor plant connected with the work was never out of operation.

(To be continued.)

UNIFORM CLASSIFICATION.

BY SAMUEL O. DUNN,
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III.

Next to the ratings and rules, the latter of which constitute the foundation of classification, the "description" of the articles classified is the most important feature of freight classification. As descriptions must in one form or another make provision for all articles of commerce, including not only those that have form and weight, but also the gases that have of late years become the tools or fruits of industry, a proper disposition of this part of the work dwarfs into significance by comparison the making of a government tariff law.

The various classifications require that the contents of all packages, as near as practicable, shall be stated in the shipping receipts. In order that the agent of the railway may know what rate to charge on an article, it is necessary that the shipping description of it shall conform substantially to the description of it in the classification. And in order that a consignment may be given a fair and legal rating it is necessary that both the description furnished by the shipper and that in the classification shall indicate the true nature of the commodity, whether valuable or not, bulky or not, how packed, whether moving commonly in large or small quantities, etc., for on these and numerous other considerations depend the class in which an article should be put that it may be given a reasonable rating, whether it should be given a C. L. rating, etc. Provisions of law requiring that tariffs must be clear, specific and understandable by a man of ordinary intelligence and experience, and that the carriers may not reserve to themselves the sole right of interpretation, obviously apply with equal force to the classifications which underlie the tariffs.

The increasing diversification of manufactures has been accompanied by a rapid growth in the number of articles to be classified. The first Official classification contained the names of about 2,500 articles. The last (34th) specifies about 6,000, an apparent average increase of 100 articles in each successive issue. The increasing refinement and diversifications of manufacturers and commerce have made more and more necessary the exercise of discriminating judgment in separating specific articles from groups of similar articles and giving them accurate descriptions. Anyone who has looked into the nomenclature of various industries and trains and has been bewildered and put to trouble by the wide variance of definitions of the same things framed by different persons, all setting up as experts, will have some idea of the labor to be done and the difficulties to be overcome in describing thousands of articles of commerce so specifically and accurately, without making a classification unduly cumbersome, that a uniform understanding as to exactly what articles are meant, will obtain throughout the country, and varying applications of rates due to different interpretations of the same classification will be prevented.

The difficulty of framing accurate descriptions and applying

equitable ratings would be great enough under present conditions of industry and commerce without being unnecessarily increased, and it is unnecessarily increased by many manufacturers, and even by producers of or dealers in raw materials, who put their commodities on the market for special purposes, and who, for the promotion of their own ends, seek to prevent the making of accurate descriptions. Their interested pleas and specious arguments and the influence they can exert with one or more roads, owing to their territorial location, often prevail against the better judgment of the classification committees. It thus comes to pass that the same articles may be found masquerading under different names and at different rating in the same classification, and that articles similar in nature receive dissimilar treatment. Likewise, differences in descriptions of the same article in different classifications may give a shipper of that article a substantially differing rating from and an unfair advantage over some shipper who happens to be located in a different classification territory. These conditions are a very convincing argument for more definite and accurate descriptions of articles; and descriptions cannot be made specific and accurate without being made uniform. Besides being a possible means and cloak for unfair discriminations, the present varying descriptions constantly incense shippers who cannot understand why their commodities should be described and rated as one thing in one territory and as another thing in another territory.

It should not be inferred that entire want of uniformity is the rule, or that such want of uniformity as exists is the result of general indifference or negligence on the part of the carriers, or that the shipper has been generally in the wrong. During many years the carriers have been much helped in the work of classification by honorable and fair-minded shippers. But the "tare" will occasionally get in—and is sometimes helped in—to the grain bin.

There is also to be considered that it is necessary to use language in descriptions, aside from the names of articles, that shall be reasonably capable of conveying only the meaning intended, and that in the arrangement of matter and choice of words the classification must be kept consistent in its several parts as to form and as to the interpretation that probably will be put on it. Anyone who has had experience with railway tariffs will realize the importance and at the same time the difficulty of measuring up to such a standard.

Another feature of the work of description of articles is the specification of packing or package requirements. In the Official classification there are nearly 1,000 articles for which no package requirements are made. While the shipper has as great—or even a greater—interest in so packing goods as to secure safe transportation as the carriers, it is obvious that there are differing elements of risk as to which the carrier should be able to speak with greater authority. The interest of both shippers and carrier should be conserved by a definite statement of reasonable package regulations governing every classified item.

It may appear that it should be easy to formulate such statements. But when such requirements are made they must be observed, and must be made to apply with equal force in all parts of the country. The committee must, therefore, give careful consideration, not only to articles now appearing in the classifications without package specifications, but to all other articles, so that only reasonable requirements, necessary to the protection of property moving throughout the country under very diverse climatic and operating conditions, will be established. This involves exhaustive investigations as to the nature of the articles themselves. Because of the present high prices of lumber, of cooperage and of wrapping textiles, and their probable future higher prices, there is a constant tendency—and one that is apt to continue—for packages to decrease in quality, the aim of shippers being to offset the increase in prices by the use of inferior materials. Unless this tendency is checked the claims for loss and damage to freight that the

railways must pay will rapidly increase, owing less to their fault than to that of shippers.

Perhaps no other phrase in the classifications has been so much abused as the abbreviation N. O. S. for the catch-all phrase "not otherwise specified." While its use has been, and seemingly will continue to be necessary, it is one of the "necessary evils." Its meaning apparently is that if another rating cannot be found, this one will apply; and when it is used about articles of a specified kind, about articles of various kinds which are made of certain materials and as a blanket for specific articles packed or shipped in forms "not otherwise specified" the probability of conflicting ratings becomes great. One illustration from the Official classification may suffice. Gloves and mittens N. O. S. are classified first class, any quantity, and fur goods N. O. S. are classified one and one-half times first class, any quantity. As fur gloves are "not specified," should they be rated as gloves N. O. S. or fur goods N. O. S.? That general terms must be used to provide for large groups of similar articles. To specify all articles individually would be an almost impossible and altogether unnecessary task. It is for the committee to so use each term and to so arrange the classification that the rating to be applied to each article can be readily determined.

This part of the committee's work also involves the determination of the method according to which the classification shall be constructed, whether articles shall in the main be arranged alphabetically, or according to their nature, agricultural implements in one group, furniture in another, etc., or according to their component materials, as brass, copper, iron, lead, wooden articles, etc. Probably the result will be the use in each case of the arrangement that seems most suitable. Certain groups of articles are recognized universally as the proper subjects for mixed carload ratings, and these should be classified together. In the main, however, the alphabetical arrangement will prevail.

Connected with the differences in rules governing mixed carload ratings already set forth in the article on the "Unification of Rules" are the great differences between the numbers of carload ratings accorded in the different territories. As the description of articles must determine whether or not provision is to be made for carload ratings, this seems to be an appropriate place for consideration of this subject. The committee of traffic men, which in the spring of 1908 investigated the feasibility of a uniform classification, found that in the Southern classification there were 3,503 L. C. L. ratings and 773 C. L. ratings, the latter ratings being 22.1 per cent. as numerous as the former; that in the Western classification there were 5,729 L. C. L. ratings and 1,690 C. L. ratings, the latter being 29.8 per cent. of the former; and that in the Official classification there were 5,852 L. C. L. ratings and 4,235 C. L. ratings, the latter being 72 per cent. of the former. These figures reflect wide differences in transportation and commercial policies and conditions in the various territories. They reflect also that much stronger belief of the eastern than of the other lines in the desirability, from a transportation standpoint, of carload, as compared with less-than-carload shipments, this attitude of the eastern roads being also reflected, of course, in the rule permitting mixed carloads. They also reflect the industrial conditions that make it possible in the East to ship in carloads a much larger number of articles between a much larger number of points than can be done elsewhere. While the western roads provide in their classification for only a relatively small number of carload rates, they provide in commodity tariffs for a large number of such rates on specified commodities moving between specified points. Again, in the Southern classification there is a wide range of "any quantity" ratings, many of which are as low relatively as carload ratings in other territories, these "any quantity" ratings being not simply a result of not providing carload ratings, but also of the competition the roads meet at many jobbing centers from water carriers on traffic from northern

manufacturing points. Such water carriers frequently provide ratings on a different unit than carloads and on a scale which closely approximates what the rail carrier would fix as C. L. In the Southern classification 33 per cent. of the L. C. L. ratings are in the fifth, sixth and lettered classes, which might be considered as carload classes, while in Official territory only 1.25 per cent. of the L. C. L. ratings are below fourth class, and in Western classification there are no L. C. L. ratings below fourth class. Of the six numbered classes and two classes governed by rules in the Official classification, seven contain L. C. L. ratings; of the five numbered and five lettered classes in the Western classification only the first four contain L. C. L. ratings, and in the Southern classification all of the six numbered and seven lettered classes contain L. C. L. ratings.

In no respect do the different classifications vary so widely as in this matter of carload ratings. The difference between the carload and less-than-carload rates means a considerable profit to the jobber at one point, who can get a carload rate which is denied to his competitor at another point. To be able to get a carload rating by commodity tariff into a jobbing point, while preventing it from being extended into the territory in which the jobber desires to do a distributing business is, indeed, a fine art.

How can these wide differences in provisions for carload business be reconciled? One serious obstacle to their removal is that they are in no small part an outgrowth of conflicting interests and competition between the railways and the various sections that they serve. As the center of population and industry have moved westward it has become harder for eastern manufacturers to hold their own in competing for business in the West and South against the manufacturers of Cincinnati, Chicago, St. Louis and other points still farther south and west. The multiplication of carload ratings by eastern lines has been a great help to eastern industries in competing for southern and western business. Now, suppose that in the effort to attain uniformity the number of carload ratings in the Official classification should be heavily reduced. Obviously, every eastern manufacturer who was deprived of a carload rating would be placed at a relative disadvantage in meeting competition from rivals in other sections, and as so many raw materials must be drawn from the West with the consequent freight absorption that his difficulties would apparently be increased unbearably. As this must result in injuring the business of eastern manufacturers, it would cause corresponding loss of traffic and earnings to the eastern railways. On the other hand, the roads in the West could not afford to make anywhere near as many carload ratings as the eastern lines have, for, whatever the ultimate result might be, the immediate result probably would be a dangerously heavy decline in earnings.

Here, again, is developed the necessity for a more general understanding of all the numerous commercial conditions surrounding the flow of traffic and a more general exercise of that breadth of view and spirit of fairness which are essential to the adjustment of a national question so that the common weal may be served.

(To be continued.)

The railways which the Chinese are building from Tien-tsin (the port of Peking) southeastward to Nan-King was located by the Germans some years ago through or near the city of Yen-chou, near which are the venerated graves of the philosophers whom we know as Confucius and Mencius. The authorities of Yen-chou have petitioned the government to change the location so that the neighborhood of these graves may not be profaned. On the other hand the authorities of Tsining, a city on the Imperial canal 22 miles from Yen-chou, have petitioned that the railway may be laid through that place, and supported their petition by sound commercial reasons, just as if they were citizens of Chicago.

ROBERT S. LOVETT.

Robert S. Lovett has been elected chairman of the executive committee of the Union Pacific and Southern Pacific, to succeed Edward H. Harriman, and Jacob H. Schiff and William Rockefeller were elected directors in place of Mr. Harriman and H. H. Rogers, and will serve on the executive committees of both roads.

This announcement is of unusual importance, because it makes it plain that the double functions performed by Mr. Harriman as chairman of the executive committees and president are to be divided in the new organization, although the exact nature of the division presumably has not yet been worked out.

Robert S. Lovett came to New York in 1906 as counsel of the Harriman lines. Mr. Lovett was born in Texas in 1860, the son of a farmer who lived near Shepard. As a youth he worked upon the farm, but when the railway was put through Shepard in 1874 he moved to that town, taking a position in the general store of E. B. Smith at a salary of \$10 a month and board.

He took care of Smith's horses, and when the train brought freight he was the one who drove to the station and carted it to the store. His interest in the new railway finally brought him into the employ of the Houston East & West Texas as station agent at Shepard.

Later he went to Houston as clerk in the freight office of the road at a monthly salary of \$40. C. B. Udell, the local agent, gave him the position. Four years ago, when Mr. Lovett was made president of the combined Houston & Texas Central, Houston East & West Texas, he appointed Udell treasurer of the merged lines.

While serving as freight clerk young Lovett studied law at night, and eventually was admitted to the law firm of Charles Stewart, then a Representative in Congress. He soon returned to Texas a country counsel of the railway in which he formerly had been employed, journeying from village to village, trying cattle cases, in which he was remarkably successful. The receivers of the road made him a district counsel, with headquarters at Nacogdoches, where he straightened out the affairs of the bankrupt company and incidentally earned promotion as general counsel of the road, with headquarters at Houston.

Gov. Brown made him assistant general counsel for the Texas & Pacific Railroad at Dallas, and when Brown retired Mr. Lovett became general counsel for the Gould property. His next step was membership in the firm of Baker, Botts, Baker & Lovett, representing the Southern Pacific. He amalgamated the system under Harriman and was elected to the presidency of the Houston East & West Texas. Harriman, recognizing his ability, made him counsel for the Southern Pacific, with offices in Houston, and in 1906 brought him to this city.

COAL CAR DISTRIBUTION.

BY ARTHUR HALE.

As the *Railroad Age Gazette* noted some months ago, one of the Circuit Courts has handed down a very sweeping decision in regard to the distribution of coal cars—a decision entirely adverse to the claims of the coal companies which own cars of their own, and also reversing the claims of the railways to special consideration in the use of their own cars for their own fuel coal. The railways and coal companies concerned in the particular cases covered were not satisfied with the decision, and it has gone to the Supreme court in connection with various other cases from other courts. Some of these cases originated in the lower courts, and others originated in hearings before the Interstate Commerce Commission. Both sides have joined in recommending expedition in

these cases, but as they have gone over until the fall term they will not be argued, even until October.

The cases all originated since the passage of the Hepburn Act, and during the car shortage which culminated in October, 1907. Some of them were pushed with a good deal of acrimony, the complainants feeling that if the railways' rules with regard to the distribution of coal cars were changed they would have enjoyed a considerably larger portion of the coal trade. The appeals have been tried since the beginning of the present period of car surplus, and consequently have been handled in a much more moderate way. Indeed, on the appeal of one of the leading cases the testimony of only one witness was taken. This practically amounted to an agreement in facts between the commission and the railway concerned. The Supreme court will therefore decide the very grave questions involved, on the records of cases handled by both sides, in a non-partisan spirit.

Car distribution, although always a difficult matter to handle properly, is comparatively simple in times of car surplus. Of course, the movement of empty cars is at all times more complicated than that of loaded cars. In the movement of loaded freight cars the officer in charge has no choice as to the destination of each unit to be moved, although in some cases he can choose between two or more routes for its movement. In the case of empty cars he has to indicate the destinations, and in many cases decide whether cars should be sent to a loading point on his own line, or delivered to one of a number of foreign lines.

In times of car surplus the first thing to be done is to fill all orders with the minimum empty haul; and here the car distributor is dealing with fairly definite data. In such times orders for cars are approximately equal to the real need. It is true that the order is always larger than the real need, but it only exceeds it by a comparatively small and fairly constant percentage. If a certain industry is in the habit of ordering ten cars a day, the car distributor's experience will tell him that it really will need only eight or nine cars a day. If a certain mining region is in the habit of ordering 500 cars a day, the superintendent of transportation knows that 450 or perhaps 400 cars is really the number it needs, and will take measures accordingly. In other words, the first rule in car distribution is, that no industry and no region loads as many cars as it thinks it will. If this rule is not well understood a grave mistake will be made in creating an over-supply of empty cars, foreign cars will be held too long on the line, and per diem payments on foreign cars will be swelled unnecessarily.

In periods of car shortage the question of car distribution becomes complicated. The supply of empty cars is extremely irregular, depending largely on the weather. One can calculate fairly well as to the unloading of cars on one's own line, but it is impossible to count on the regular return of empties from foreign roads. With this irregular supply of empties it is always a question whether it is best policy to allow the empties to be moved naturally—that is, by return locomotives which have moved loaded cars—or whether the movement of a special train of empties is justified when there is no return load ready for the locomotive.

A third unknown quantity is the actual need of the shippers. A shortage in coal cars means a high price for coal, and the moment cars begin to get scarce, every shipper, feeling that he will receive only a portion of his order, inflates that order; and he is to a certain extent justified in doing this, because in periods of car shortage many shippers can load an unusually large number of cars. The officer in charge of the distribution therefore "does the best he can," relying largely on his reports, but still more on his experience.

In the distribution of most classes of cars the American railways have always been fairly successful. Extreme shortages, for instance, in box cars have been local and of short duration; and the same can be said of all other classes of cars

excepting coal cars. In point of fact, the only car distribution cases before the courts have been coal car distribution cases, and this is an indication that the distribution of other classes of cars has been, on the whole, fairly satisfactory at all times.

The reason that the distribution of coal cars has been unsatisfactory to all concerned is, chiefly, this difficulty of ascertaining the real wants of the coal shipper. It has been said that at present the production of bituminous coal has in it more of the elements of a sport than of a trade. It is more like hunting or fishing than it is like raising grain, for instance. In many coal regions, anyone with a rudimentary knowledge of coal mining and a few dollars can open a mine. It will cost him very little. Therefore, he mines coal every fall much as he shoots birds. He can produce his first coal very cheaply, and if he gets two or three cars a day during the winter months he can make a profit, even if he shuts up his mine during the summer.

As a result the bituminous coal mines of this country are enormously over-developed. On some railways the capacity of the mines for shipping coal is three and even four times the present demand. With such a state of affairs it can be readily seen that an officer in charge of distribution must scan his orders for coal cars much more carefully than other cars.

With this almost unlimited supply of coal in sight, the situation is further complicated by the fact that there is very little coal stored. Except where coal is transhipped from vessels to cars there are no large stores of bituminous coal, and most industries of the country are conducting their plants on an absolutely hand-to-mouth basis so far as coal is concerned. So are the large office and apartment buildings.

The amount of coal moved does not vary greatly as between summer and winter, but of course more coal is burned in winter than in summer. As a result it is not at all unusual for prices to rise sharply in the winter on the basis of a comparatively slight increase in the demand. The minute the demand exceeds the supply every mine orders cars for its full capacity, and the railways are confronted with an enormous increase in the orders for cars, only partially justified.

To make the situation still more uncertain we have the fact that the ordinary contract under which the coal is bought and sold is not in practice enforced as against the consumer. The coal year runs from April 1st to March 30th, and it is customary for consumers of coal to contract with shippers for a certain amount of coal to be divided equally as nearly as may be between the different months. The shipper seeks to guard himself by inserting strike clauses, etc., while the purchaser seeks to guard himself by making the contract cover the maximum amount of coal which he may use. If the purchaser thinks there is danger of a coal shortage he will contract with more than one party for an aggregate amount of coal vastly in excess of his requirements. Whenever an industry for any reason shuts down, in whole or in part, it reduces or cancels its order for coal as a matter of course, and the desire of the coal shipper to secure a renewal of contracts is such that under the circumstances mentioned the reduction is accepted and the contracts almost never enforced against the consumer, while often enforced against the shipper, especially where the current price rises above the contract rate. This uncertainty as to contracts is another element in increasing the uncertainties of the coal trade.

These questions and these uncertainties have been pressing on the railways intermittently for thirty years and more. When trade relaxed, as it does generally in summer, the questions were forgotten; when a car shortage came again in the fall the questions were tackled anew. It was not until the Hepburn Act and the coal and oil investigation that these questions have been kept continuously alive during a series of years. The railway men called upon to handle this question have had it presented to them in five phases:

First: They found it difficult to keep up their own supply of fuel for their engines.

Second: Connecting railways buying coal on their line found the same difficulty.

Third: The operators whose mines had been shut during the preceding period of car surplus demanded "their share" of the cars.

Fourth: The operators who had been shipping coal during this preceding period of car surplus demanded that their car supply be not reduced.

Fifth: The owners of private cars demanded the use of their cars and "their share" of the railway cars as well.

These questions were first handled by the train-masters and superintendents in direct charge of the lines in the coal regions. They have gradually been referred to railway headquarters, and at last are to be settled by the Supreme court.

The first question (that of fuel supply) is a life and death question to railways. One of the first signs of a car shortage is, that somehow or other the mines supplying a railway with coal clip a few cars off the supply. The railway man takes it up with the mine operator and explains that unless he has his coal he cannot run his road—and in the old days the railroader used to add to this that unless the necessary supply of coal was forthcoming the car supply to that particular shipper would rapidly drop.

To this the mine owner would say, "But, if you make me ship you all this coal you ought not to cut down my regular supply of cars for other people." This argument has been very generally accepted, and it has become a very general custom to separate the car supply for fuel coal from the car supply for other coal. This plan has become more popular with railways because they found they could secure fuel coal at a lower price when they absolutely guaranteed a supply of "fuel cars," without reference to shipments to other parties. This is a thing the Interstate Commerce Commission is trying to stop, and which the railways are still fighting for.

The second question is similar. The railways which do not have coal mines on their lines find themselves at a disadvantage the minute that a car shortage comes. Failing a supply of coal, they resort to the railway on which the mines are operated and offer to send cars for their own coal if the use of these cars can be protected. The cars have been accepted under various arrangements, the more usual one being to put them on a plane with the "fuel cars" of the coal road, the mine securing such cars being assured of a regular car supply for these shipments, and being willing to make a lower price for fuel shipped in such cars. This question—the question of the right of the railway to protect such cars—is also in controversy between the commission and the railways, although the coal roads, which are the only ones represented in the litigation, are not urging their claims quite as strongly as they are for the control of their own "fuel cars."

The third and fourth questions present a much more complicated problem. There are generally two classes of coal miners—those who operate their mines all the year round and those who operate theirs only when there is a car shortage—that is, when prices are high. The all-year-round operators are the ones who have especially good coal, or especially good mines; that is, they are the successful coal operators, and this usually includes the larger coal operators. They are usually the operators who make long-time contracts with consumers of coal at regular and comparatively low prices. They want these contracts protected, and they also want to sell their "spot coal" at high prices.

The coal miners who shut up their mines in summer often have poor coal or poor mines, which they can work only when prices are high, and prices, of course, are never high except when there is a shortage of cars. In this class, however, there are to be found quite a number of coal miners who undoubtedly could make regular contracts at low prices, but who believe that more money is to be made in the end by shipping their coal only when prices are high. When higher prices do come they demand "their share" of the cars, and

their share can be supplied only by reducing the share of the regular shippers.

The railway naturally sympathizes with the regular shipper, not only because this is recognized good business policy, but because he has for allies all the industries, small and large, which make long-time contracts for coal. The only allies the irregular shipper can drum up are the speculative coal dealers who are deservedly unpopular with railways. Accordingly, many efforts have been made by the railways to "protect contracts," and arbitrary assignments of cars have been made from time to time to secure this end. As doubt has been thrown on the legality of such arbitrariness they have been discontinued, but this was not the only reason. As noted above, coal contracts are frequently not enforced against the consumer. A railway man having once "protected a contract" through the winter only to see it wither up in the summer, when trade is scarce, is more careful next time. The contracts are, however, largely enforced against the coal operator, and in his efforts to fill his contracts he is forced to play into the hands of the irregular shippers and to buy of them the coal which they have loaded in "their share" of the cars. It has been by no means unusual for one of these irregular shippers to load cars with coal without in the least knowing what he is going to do with it, on the chance of disposing of it to regular shippers short on their contracts. Before demurrage rates were so generally enforced the terminals of coal roads were often blocked with "dead coal" owned by such shippers, which they were holding for high prices. As a result of such difficulties many coal miners have bought coal cars of their own.

This opens the fifth question. These miners have decided that if the railways could not protect their contracts they would do it for themselves. The railways have opposed these purchases as far as they could. A private car is an extra trouble to a railway in several ways, and the railways have gone so far as to buy them up in many instances. Some coal roads have been successful enough to nip this growth in the bud, but wherever it has got started it has proved very difficult to eradicate. Even the commerce law, designed to discourage such special arrangements, has tended to keep up the private car system, for whenever one operator on a railway owned private cars the railway could not refuse to handle cars for another.

These private cars are of no advantage to the owners during periods of car surplus. The mileage paid by the railways is not enough to keep them in repair and pay for interest and depreciation. They are bought solely to supplement the regular car supply in periods of car shortage, and the owners therefore uniformly demand that they be supplied with their own cars in addition to "their share" of the railways' cars. The commission has ruled (with one important exception) that the private cars must count as if they were railway cars; the lower courts are divided on the subject. Some of the railways are backing up the private car owners and the private car owners are holding out for their full rights.

Of these five questions the ones most sharply fought over are Nos. 1, 2 and 5. They can be combined in one question: What right has an owner of a car to the use of his own car?

The other two questions, though much more complex, have received much less attention; indeed, the questions have been so put to the Supreme Court that they may not be definitely decided in the cases now being considered. They can also be combined in one question: What is the "fair share" of cars for a coal mine?

In the old days this question was decided offhand and locally on varying bases. In a celebrated case coal cars were divided on the basis of the number of coke ovens owned, whether such ovens were used or not. In other cases cars were divided on the basis of the number of men employed by each mine. As noted above, efforts have been made to "protect contracts," and other methods have obtained. As time passed, however, there has been a pretty general agree-

ment that the cars shall be divided on the basis of the capacity of the mines and trying to divide cars pro rata.

This would be a very satisfactory answer to our questions 3 and 4 if there were any general agreement as to what the "capacity" of a mine was.

As we examine the varying practices we find on the one side the claim of the old and regular miner that his capacity is to be measured by what he has produced in the past. On the other side, the new and irregular miner claims that his capacity be measured by what he can produce in the future. The railways try to steer a middle course, and most of their rules for rating combine these two elements, though in differing proportions. In some cases they turn this troublesome question over to the shippers themselves, working through a joint agent. The commissions seem generally to favor the new mines, but without altogether denouncing the mixed plan.

It will be, of course, a pity if controversies on capacity and distribution based thereon should arise in the coming period of car shortage without an immediate prospect of settlement; but it should be remembered that the present systems of rating mines have only been formulated within the last few years, and a postponement of the decision of this question will give an opportunity for further experiment and fuller evidence.

There is much to be said on both sides of this question. It is impracticable in every case to rule that past performance should be the sole element to be considered in determining the capacity of a mine. When a man wants to open an absolutely new mine he certainly has a right to some cars, and if the mine is absolutely new he cannot be rated by his past performance. It may be urged that he should open his mine when cars are plenty, when he can have the use of as many cars as he wants, for, it should always be remembered in all these discussions, that when cars are plentiful all orders are filled, and these various questions arise only during the comparatively limited periods when cars are scarce. As noted above, it is nearly two years since there has been any real scarcity of coal cars, and these questions will again press upon the coal trade and the railways only when there is a shortage.

There are, however, a great many men who do not care to open their coal mines when coal prices are low, and it has been generally agreed, even by the commission and the courts, that it is perfectly proper to give such parties who are opening their mines a reasonable arbitrary number of cars for "development" for a reasonable time. In point of fact, such cars are not always used for development, and there are cases on record where the same mine, after closing for a summer, demands another "development" arbitrary during its second winter, and perhaps its third. The arrangement for arbitrary development, however, eliminates these new mines, and the real question is between the mine which works all the year round and the mine which works only during the season of shortage. The regular miner demands that he be rated on the basis of his daily shipments for a year or more. The irregular miner wants to be rated on his maximum daily shipments, or on the shipments which he could make if he were running full.

Various methods have been employed to compromise these difficulties. Some roads rate a mine by a "surprise" test. Without notice they give the mine all the cars it can load, and more, for three days or a longer period, and rate the mine on the basis of the shipments made during the test. Other roads have the mines carefully inspected, the number of working places counted, and the facilities for getting out the coal considered. The figures obtained from such an inspection are termed the "physical capacity" or the "maximum capacity" of the mine and they are usually averaged with the actual shipments made for given periods to obtain a basis for rating.

There is plenty of room for improvement and development of the methods of rating now in use. It has, however, been pretty clearly settled that any undue importance given to the maximum capacity of a mine results in an overdevelopment of

mines, which apparently serves no good purpose and is an actual source of danger. Wherever the system of distribution on a railway leads to the overdevelopment of mines, large portions of these mines are as constantly vacant and unused as if they were abandoned, and it is not infrequently in such portions that dangerous gases develop undiscovered.

Returning now to our questions involving the right of a car owner to a use of his car in the three cases cited. It has been the usual practice that the coal operator owning private cars has had the exclusive use of his own cars, and also the same share in the railway cars as if he had had none of his own. This right, of course, to a share in railway cars has been modified on days when he has had so many of his own cars that he could not use his allotment of railway cars. In the same way, the railway sending its cars to a mine for its own fuel has given these cars to the mine without reducing the mine's share of cars for its regular shipments of "commercial coal," and it has accepted "fuel cars" from its connections on the understanding that they will be protected in the same way.

These arrangements have been strenuously resisted by the coal operators who had no cars of their own, and who had not made contracts with railway companies to supply them with fuel. They have claimed that they should have a full share of all the cars, based on their capacity, without any reference to the ownership of the cars or any other contract between the car owners, the coal operators and the railways. Their chief reliance is in a clause in the first section of the Hepburn act, which provides that, "The term 'transportation' shall include cars * * * irrespective of ownership or of any contract, express or implied, for the use thereof * * * and it shall be the duty of every carrier * * * to provide and furnish such transportation upon reasonable request therefor." They argue that under this clause a car is a car, and that when the capacity of a mine and its proportion of cars is determined, it has a right to this proportion of the total cars available, without regard to their ownership. In support of the justice of their claim and the injustice of the present practice, they point to actual cases where, for certain periods of time, the cars supplied on an arbitrary basis—that is, the company fuel cars and the private cars—have greatly exceeded the cars provided for ordinary commercial coal. They also claim that not only should the total car supply be divided on the basis of mine capacity, but that the engine service should be divided on a similar basis, as well as the use of all other railway facilities, such as sidings, main tracks, etc. Any other division of facilities they claim is an unjust discrimination against them, and gives an undue or unreasonable preference or advantage to the mines which are given the exclusive use of these fuel cars and private cars in addition to their regular share of cars based on their capacity.

The railways, in reply, point to the impracticability of dividing up their general facilities, such as motive power, tracks and sidings, among their patrons on any definite basis. They also challenge the production of evidence that any division of such facilities among their patrons has resulted either in unjust discrimination or undue or unreasonable preference or advantage; and it must be confessed that although able counsel on the part of the coal operators have argued at great length on this subject, there is little, if any, evidence that the railways have discriminated unjustly or given undue preference in such matters. We will therefore dismiss this phase of the question.

In defending their position in opposition to the other contentions named, the railways are divided into two groups: One group of railways admits that any arbitrary allotment of cars to a mine reduces its capacity in that day to a certain extent. The other railways who do not admit this, and the owners of the mines who at present have the use of their own cars or have profited by an arbitrary car supply for their fuel coal, are inclined to pass over this point rather lightly, their chief argument being that any such arrangement will make it

very difficult for them to keep account of their distribution correctly. In the only cases where this question has come squarely before the court, the practice of the railways in diminishing the capacity of the mine by the capacity of the arbitrary car supply was sustained. This would appear to be good, common sense. Supposing there are two mines side by side, each with a daily capacity of 20 carloads, and that one of these mines owns its own cars and the other does not. Supposing that on a certain day one of these mines should receive 10 of its own cars and there are only 20 railway cars available. It does seem unfair that one of the mines should work absolutely full and the other only half full, when the capacity of the first mine, so far as the railway cars were concerned, has been reduced by one-half, by the receipt of its own 10 cars. It would seem fair in such a case to divide the 20 railway cars available, on the basis of the capacity of the mine after the private cars of the first mine had been filled; that is, to consider the one mine as having a capacity of ten cars left, and the other its original capacity of 20 cars, which would justify a division of the 20 cars on the basis of one to two.

This proposition, however, does not go far enough for the commissions, state and interstate, who have taken the ground that all private and fuel cars shall be distributed on exactly the same basis as regular railway cars. The only exception to this occurs when a mine owning private cars receives more of its own cars in a particular day than its percentage would admit. Suppose, in the case cited above of two mines with a capacity of 20 cars each, if there were only 16 cars available on a day, and 10 of these belonged to one of the mines, that mine would receive its 10 cars and the other only six, for the commissions have not gone so far as to say that cars owned by one mine must be placed at another. In the same way if, of two 20-car mines, one had a fuel order of 10 cars and only 16 cars were available in one day, that mine would receive its ten cars for fuel and nothing for outside shipments, while the other mine would receive the remaining six cars.

With the private car it is simply a question whether this advantage in distribution is or is not "due" to the owner. The law forbids an "undue advantage"; it does not forbid a due advantage. The law does not forbid a coal operator to own cars. Now, we may ask, what advantage is due to the coal operator on account of this ownership? It must be assumed that some advantage is due to him, and it would appear that this advantage in distribution is absolutely the only advantage that the owner of a private coal car now has. It seems doubtful if the Supreme court will take this advantage away from him. If it does it will come very near confiscation, for it will certainly render the private coal cars valueless, excepting in the infrequent cases noted above.

In the above remarks we have considered the private car owned by the coal miner. There are certain private coal cars owned by consumers of coal, and these can be classed with the "foreign fuel cars" sent to other railways for shipments of fuel coal to be consumed by their owners. A distinction has been made between these cars and the fuel cars of railways on whose lines the coal is mined. A distinction has also been made in one case between the private cars of the coal consumer and of the coal shipper; but it is hard to see how their situation differs. If it is lawful for any party which does not own a railway to own a railway car and contract with a railway for its movement, it is very hard to see that no advantage is due the owner, especially in the case of coal cars at the present rate of mileage and of car repairs. This preference in distribution is the only advantage the car owner has. Possibly the passage in the first section of the Hepburn act, which defines "transportation" as to include cars, is intended to legislate private cars out of existence and deprive their owners of all advantages, but this does not seem at all clear.

There remains the controversy as to the railway fuel car, and here the first point of the railways is, that their purchase

of fuel from mines along their road is not commerce and is therefore not subject to the Interstate Commerce act. Many railways receive a large proportion of their fuel direct from the mines into their locomotive tenders, and there is no claim on the part of any of the commissions that such a delivery of coal should have any effect on the car distribution. It is admitted that such a delivery of coal is not commerce and does therefore not come under the act. It would be possible—although undoubtedly inconvenient—for a locomotive to use an ordinary coal car to carry its supply of fuel; and supposing it did, how would the delivery of coal from a mine into this car differ from the delivery of coal into an ordinary engine tender? Indeed, it would seem that a railway has a right to buy coal or any other supply from any party on or off its line and load it in any vehicle—a wheelbarrow, a cart, a locomotive tender or a car—and can then transport the material for its own use by road or track without rendering itself open to "regulation" under the Interstate Commerce act.

It will be seen, therefore, that the railways have two principal arguments to sustain them in protecting the car supply for their own fuel. First, the claim that this purchase of fuel from mines at points on their line is not commerce and therefore is not subject to the Interstate act; and second, they have the same claim that the individual car owner has that there is something due for the ownership in the car and that the only thing that possibly can be due him is a certain preference in car distribution. It seems quite possible that the Supreme court may sustain both of these contentions; but it is much more doubtful that they will decide that an individual may have the use of his own cars and a full share of the railways' cars if any arbitrary supply actually reduces the capacity of the mine for loading these railway cars. It is also quite un-

certain what decision, if any, the Supreme court will make on the question of rating mines at their capacity.

TRAIN RESISTANCE.

BY F. J. COLE,
Consulting Engineer, American Locomotive Co.

IV.

By dynamometer tests, the actual energy required in starting trains composed of medium weight loaded cars, is ascertained to be about 9 lbs. per ton with corrections for acceleration and grade. The resistance to starting per ton for a train is less than for single cars, because the springs and slack in draw gear permits motion, to be imparted to each car separately. The resistance to starting of single cars has been found by various investigators to be from 14 to 22 lbs. per ton (2,000 lbs.) and by some as high as 28 lbs.

The rapid decrease of tractive power with increase of speed is characteristic of locomotive engines. Take the case of a locomotive capable of exerting a maximum tractive power of 36,000 lbs. at slow speeds behind the tender, then on straight level track at 9 lbs. per ton, a train weighing 4,000 tons could be started. At 35 miles per hour, or about 950 ft. piston speed of the average freight locomotive, only .435 per cent., or 15,660 lbs., is available (see Fig. 8). With this tractive

power the resistance would be $\frac{15660}{4000} = 3.92$ lbs. per ton.

For cars weighing 50 tons, the amount per ton in Fig. 5 is 3.94, illustrating the fact (often overlooked) that the resistance of cars does not materially increase up to speeds of 30

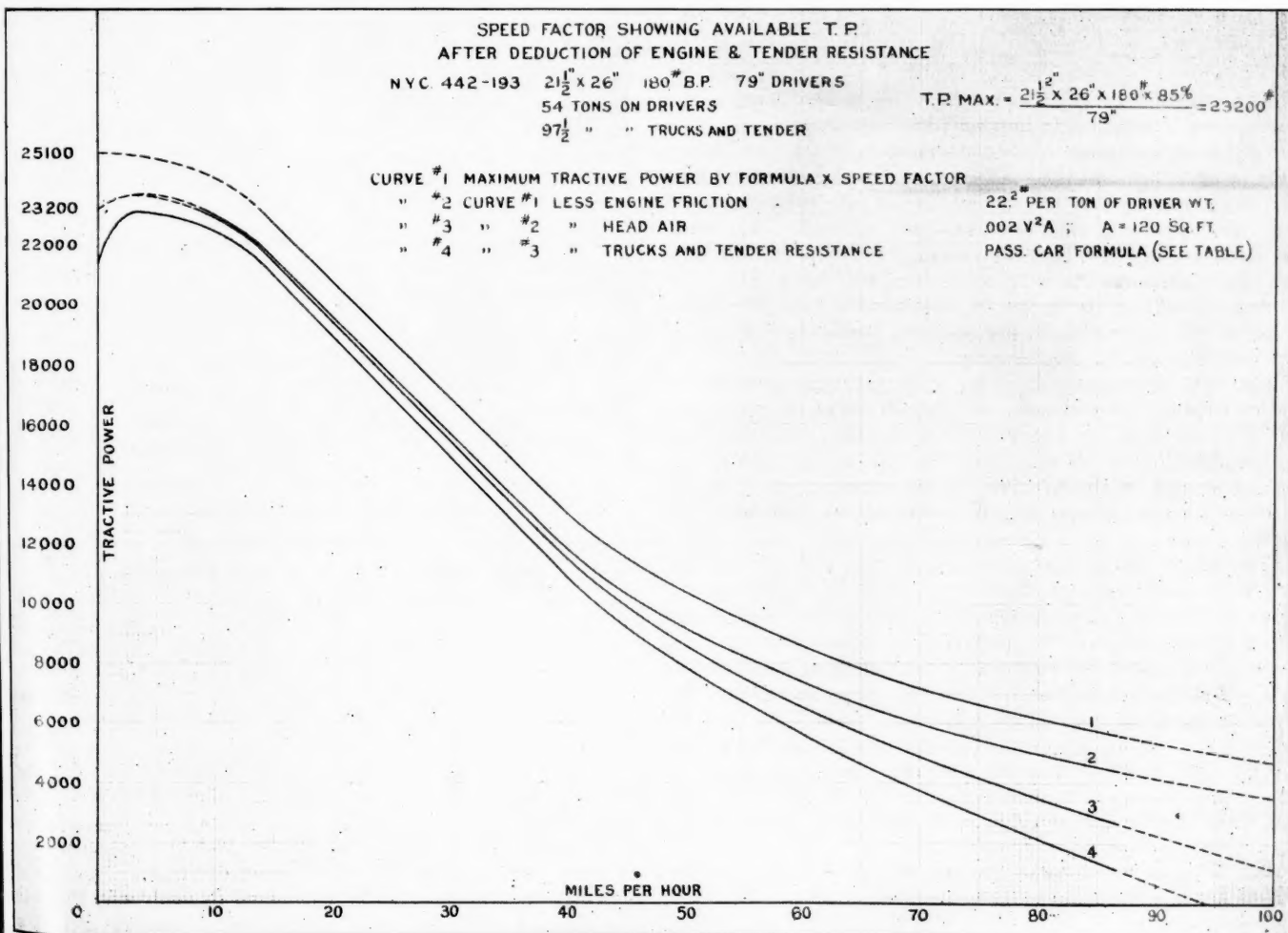


Fig. 9.

or 35 miles per hour but the drawbar pull of the locomotive does materially decrease with the speed.

Journal Friction at Starting.

	Per ton.
Wellington's conclusions from journal tests above, say..	19 to 25 lbs.
Wellington's conclusions from gravity tests of rolling stock (see Trans. Am. Soc. C. E., February, 1879) at least	14 " 18 "
Prof. R. H. Thurston (Friction and Lubrication, page 175) W. Va. oils.	22 " 28 "
Do., sperm	14 " 28 "
Do., lard.	14 " 22 "
Prof. Kimball (Am. Journal Sci., March, 1878, or Fr. and L., page 186)	22 " 31 "

No railway cars can start themselves from rest, nor can they in general be started without the use of much force on a grade of .7 per cent. (= 14 lbs. per ton), but they will generally (but not always) start themselves on a grade of from 1.1 to 1.2 per cent. (2,240 lbs. per ton), indicating an initial friction of 20 to 24 lbs. per ton. (Wellington's Railway Location, page 921.)

From experiments made on a grade of 1 in 132 (equivalent to 15.2 lbs. per ton (2,240 lbs.)), Aspinall concludes that starting resistance is about 17 lbs. per ton (2,240 lbs.) = to 15.2 lbs. per ton (2,000).

SPEED FACTORS.

The curves on Fig. 9 are derived from Fig. 8, published last week (p. 455), which gave in graphic and tabular form the speed factors and horse-power characteristics in connection with piston speed, and show the maximum tractive power of a 442-193 locomotive, curve 1 being the maximum tractive power at different speeds, curve 2 the engine friction, curve 3 the head air resistance and curve 4 the engine trucks and tender resistance. The available tractive power, therefore, at any speed, can be measured vertically on the diagram to its limitation imposed by the curve No. 4, showing the following available tractive powers:

At starting	21,400
5 miles per hour	23,000
10 " " "	22,400
15 " " "	21,000
30 " " "	14,900
70 " " "	3,700

At approximately 94 miles per hour the entire energy of the locomotive is absorbed in moving itself and tender.

In the curves shown on Fig. 5 (Sept. 3, p. 413) no distinction is made between the resistance of empty and loaded cars, but it is evident that the values for weights below 20 or 25 tons are applicable only to empty cars, so that in a general way it may be stated that the curves from 10 to 22 tons refer to empty cars and from 25 to 72 tons to loaded cars. The curves, therefore, could not be consistently used for loaded cars of small capacity, as, for instance, those used abroad, or on very old cars in this country.

Fig. 10½ is prepared in order to establish a consistent relation between the resistance of the wide range of loaded cars, 15 to 72 tons, and for empty cars, the weights of which would be consistent to the above range. The resistance in pounds per ton is written on the left hand of the sheet, and in a similar manner the pounds per car are written on the right-hand side of the sheet.

The curve giving the resistance in total pounds per car loaded is consistent for cars weighing 72 to 75 tons loaded with the P. R. R. tests—namely, 3 lbs. and 2.9 lbs., respectively. In a similar manner the resistance for small cars having a total weight of 15 tons loaded is derived from English cars, the resistance approximating 6.4 lbs. per ton. While the English cars, on account of the rigid wheel base, are not strictly comparable with the American cars having trucks, yet on account of the extremely short wheel base the action of the cars in the track is almost the same for loaded trucks, and on roads having curves of large radius there should be but little difference.

In the curve "pounds per car empty" is given the percentage of empty car resistance to the loaded car resistance. The curves "pounds per ton empty" and "pounds per ton loaded" are derived by dividing the weight of the car either empty or loaded into the total resistance either empty or loaded.

In the curve "weight of car empty" is given approximately the percentage of weight of cars of varying capacities from the total loaded weight. For instance: The empty weight of a car having a total weight loaded of 15 tons is 40 per cent., or 6 tons. In a similar manner the empty weight of a car having a total weight loaded of 75 tons will be 21.5 tons.

Of course, these weights only represent average conditions, but they may be taken as representing approximately the usual conditions of freight cars.

In Table 8 are given the figures derived from Fig. 10½.

TABLE 8.

Weight, in tons.		Per cent. of loaded weight.	Resistance in lbs. per car.		Per cent. loaded resistance.	Resistance, lbs. per ton.	
Loaded.	Empty.		Loaded.	Empty.		Loaded.	Empty.
75	21.0	28	216	118.5	54.5	2.9	5.63
70	20.3	29	214	118.9	55.0	3.07	5.82
65	19.5	30	211	117.0	55.5	3.24	6.0
60	18.6	31	207	116.0	56.0	3.43	6.26
55	17.6	32	201	114.5	57.0	3.65	6.5
50	16.5	33	195	113.0	58.0	3.9	6.85
45	15.3	34	187	111.0	59.0	4.18	7.26
40	14.0	35	178	107.0	60.0	4.4	7.65
35	12.6	36	166	101.5	61.0	4.74	8.05
30	11.1	37	152	94.0	62.0	5.07	8.45
25	9.5	38	136	86.0	63.0	5.44	9.05
20	7.8	39	117	75.0	64.0	5.91	9.6
15	6.0	40	96	62.0	65.0	6.4	10.3

The method of figuring the maximum tonnage for a certain class of engine on a 0.5 per cent. grade, considering the resistance of the train, tender, parts of locomotive supported on trucks and machinery friction separately, is given below:

Example.—What drawbar pull can be exerted behind the tender of a consolidation locomotive (280-236), 23 x 32 in. cylinders, 63-in. drivers and 200 lbs. boiler pressure, at 20 miles per hour on a 0.5 per cent. grade?

T. P. (85 per cent. B. P.)	45,700 lbs.
Weight on drivers	106 tons.
" " trucks	12 "
" of tender (% load)	118 tons.
	90.5 "
	178.5 "

Grade resistance	10 lbs. per ton
Piston speed	569 ft. per min.
Speed factor (from table) .....	.71
Tractive power at 20 m. p. h.	45,700 x .71 = 32,450
Engine friction	106 ton x 22.2 (from table) 2,350
Grade resistance	drivers 106 x 10 1,060
Weight of tender (% load) and engine trk	72.5 x 13.94 1,010
	4,420
	28,030

What weight of train with cars of different capacities can be hauled, conditions as above? (The capacity includes the light weight of car and load.)

20-ton cars	$\frac{28,030}{17.84} = 1,570$ tons.	50-ton cars	$\frac{28,030}{13.94} = 2,010$ tons.
30-ton cars	$\frac{28,030}{15.78} = 1,775$ tons.	60-ton cars	$\frac{28,030}{13.44} = 2,090$ tons.
40-ton cars	$\frac{28,030}{14.66} = 1,910$ tons.	72-ton cars	$\frac{28,030}{13.00} = 2,160$ tons.

TABLE 3.—Friction of Locomotives.

	No. of engines.	Class.	Weight on drivers.	Driving axles.		Total.	Friction—	
				No. on each.	W't.		Lbs. pr ton.	Per cent. of w't on drivers
P. R. R.	585	280-189	164,500	4	20.5	...	23.2	1.160
St. Louis	628	Comp.	65,350	2	16.3	...	22.7	1.135
Testing Plant	3,000	442-133	110,000	2	27.5	...	20.0	1.000
Average	2,512	442-164	87,850	2	21.9	...	22.8	1.140
4 tests							22.17	1.109
Purdue		442-176	95,000	2	23.75	548	11.5	0.575
Purdue		440-85	56,000	2	14.0	418	14.9	0.750

C. & B. & Q. R.R. estimate resistance of engine and tender at 15 to 18 lbs. per ton at 10 to 32 m. p. h.
Boston & Maine estimate resistance of 260 engine and tender at 27.8 at 6 m. p. h.; at 17.9 at 10 m. p. h.
Baltimore & Ohio, no reliable data: they consider resistance of engine and tender about 10 lbs. per ton at 6 to 8 m. p. h.

LOCOMOTIVE OR MACHINE FRICTION.

Some figures are given in Table 3 on this subject. From the P. R. R. St. Louis tests the figures 22.2 lbs. by weight on drivers for machine or internal locomotive resistance was derived. The curves in Fig. 10 in combination with head air

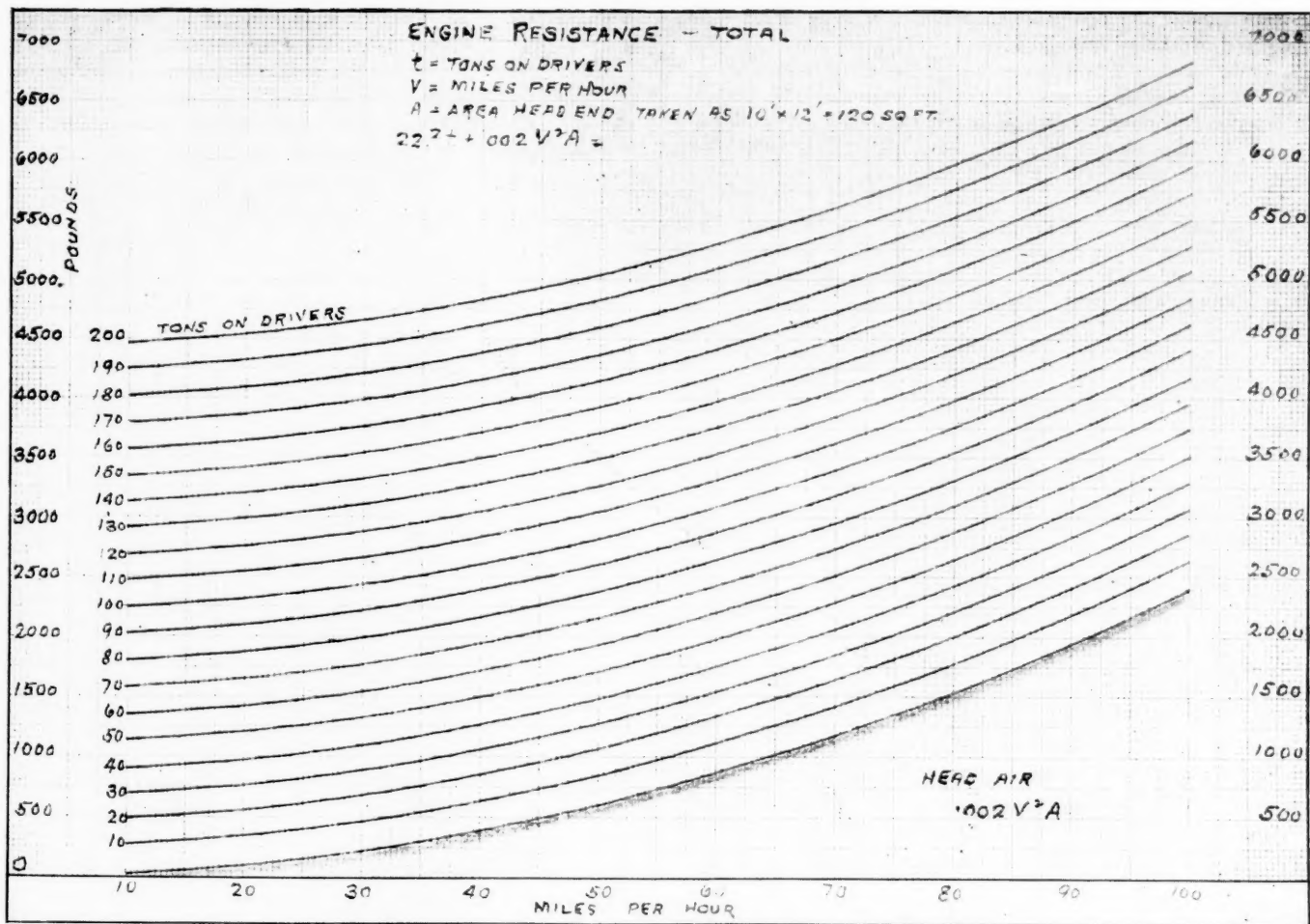


Fig. 10.

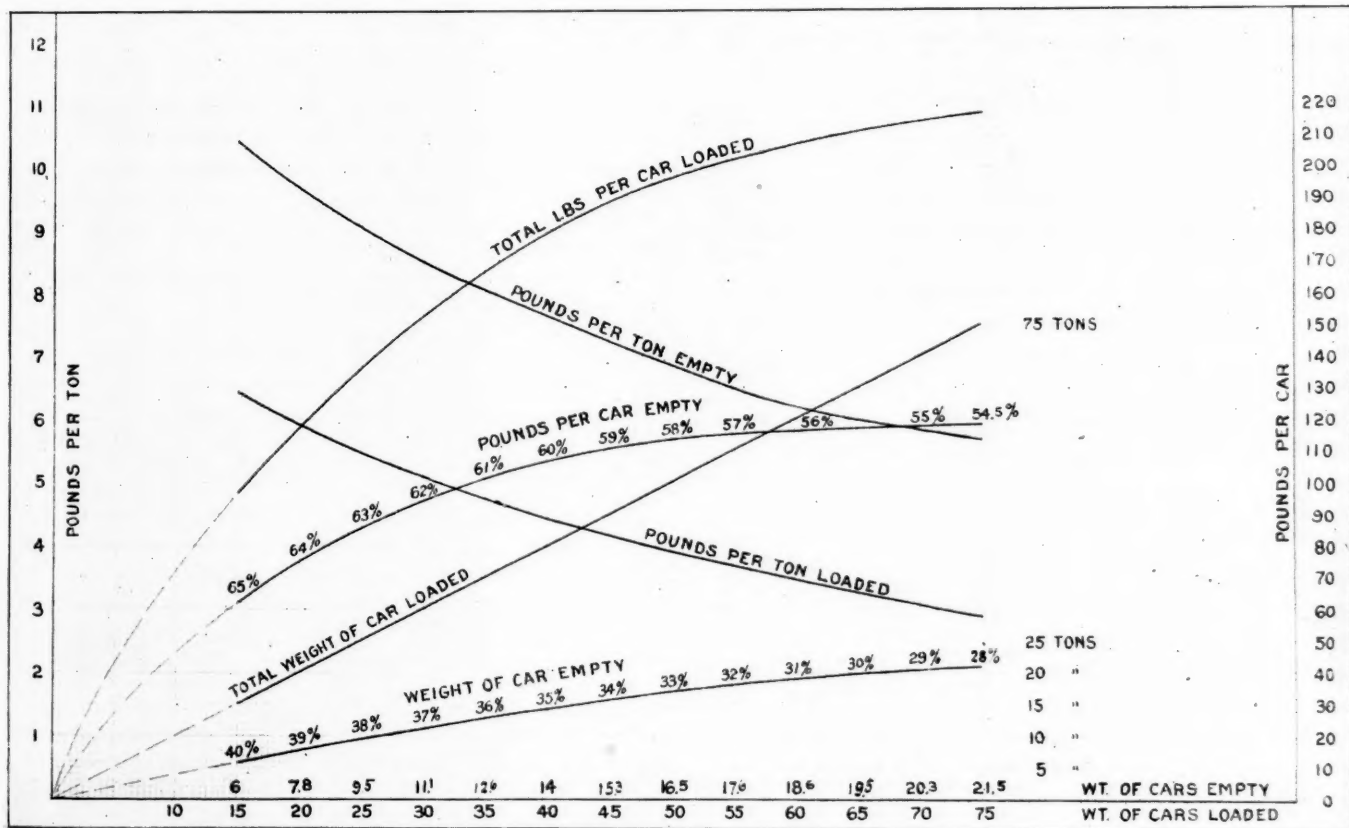


Fig. 10½—Resistance of Freight Cars and Ratio of Loaded to Empty Weight.

pressure (.002 V² A) are based on these figures. The same information in tabular form is given in Table 4.

CURVES.

The resistance of curves is usually expressed in pounds per ton per degree of curvature, and is variously estimated by

The resistance of locomotives in passing on curves is evidently higher than for cars, because of their long driving wheel base; that portion of the weight supported on trucks or trailing wheels should offer no greater resistance than cars, but that borne upon the drivers follows other laws, which it

TABLE 4.
Machine friction 1.11 per cent. weight on drivers.
Head air resistance .002V² x area, taken at 10 ft. x 12 ft.
Table gives 22.2 x t + .002V² A = pounds.
t = tons on drivers.

Tons on drivers.	10.	15.	20.	25.	30.	35.	40.	45.	50.	60.	70.	80.	90.	100.
10	265	275	320	370	440	515	605	710	820	1,085	1,400	1,760	2,165	2,620
15	355	385	430	485	550	625	715	820	935	1,195	1,510	1,870	2,275	2,735
20	470	500	540	595	660	740	830	930	1,045	1,310	1,620	1,980	2,390	2,845
25	580	610	650	705	770	850	940	1,040	1,155	1,420	1,730	2,090	2,500	2,955
30	690	720	760	815	880	960	1,050	1,150	1,265	1,530	1,840	2,200	2,610	3,065
35	800	830	875	925	995	1,070	1,160	1,265	1,375	1,640	1,955	2,315	2,720	3,175
40	910	940	985	1,040	1,105	1,180	1,270	1,375	1,490	1,750	2,065	2,425	2,830	3,290
45	1,025	1,055	1,095	1,150	1,215	1,295	1,385	1,485	1,600	1,865	2,175	2,535	2,945	3,400
50	1,135	1,165	1,205	1,260	1,325	1,405	1,495	1,595	1,710	1,975	2,285	2,645	3,055	3,510
55	1,245	1,275	1,315	1,370	1,435	1,515	1,605	1,705	1,820	2,085	2,395	2,755	3,165	3,620
60	1,355	1,385	1,430	1,480	1,550	1,625	1,715	1,820	1,930	2,195	2,510	2,870	3,275	3,730
65	1,465	1,495	1,540	1,595	1,660	1,735	1,825	1,930	2,045	2,305	2,620	2,980	3,385	3,845
70	1,580	1,610	1,650	1,705	1,770	1,850	1,940	2,040	2,155	2,420	2,730	3,090	3,500	3,955
75	1,690	1,720	1,760	1,815	1,880	1,960	2,050	2,150	2,265	2,530	2,840	3,200	3,610	4,065
80	1,800	1,830	1,870	1,925	1,990	2,070	2,160	2,260	2,375	2,640	2,950	3,310	3,720	4,175
85	1,910	1,940	1,985	2,035	2,105	2,180	2,270	2,375	2,485	2,750	3,065	3,425	3,830	4,285
90	2,020	2,050	2,095	2,150	2,215	2,290	2,380	2,485	2,600	2,865	3,175	3,535	3,940	4,400
100	2,245	2,275	2,315	2,370	2,435	2,515	2,605	2,705	2,820	3,085	3,395	3,755	4,165	4,620
110	2,465	2,495	2,540	2,590	2,660	2,735	2,825	2,930	3,040	3,305	3,620	3,980	4,385	4,840
120	2,690	2,720	2,760	2,815	2,880	2,960	3,050	3,150	3,265	3,530	3,840	4,200	4,610	5,065
130	2,910	2,940	2,980	3,035	3,100	3,180	3,270	3,370	3,485	3,750	4,060	4,420	4,830	5,285
140	3,130	3,160	3,205	3,260	3,325	3,400	3,490	3,595	3,710	3,970	4,285	4,645	5,050	5,510
150	3,355	3,385	3,425	3,480	3,545	3,625	3,715	3,815	3,930	4,195	4,505	4,865	5,275	5,730
160	3,575	3,605	3,650	3,700	3,770	3,845	3,935	4,040	4,150	4,415	4,730	5,090	5,495	5,950
170	3,800	3,830	3,870	3,925	3,990	4,070	4,160	4,260	4,375	4,640	4,950	5,310	5,720	6,175
180	4,020	4,050	4,090	4,145	4,210	4,290	4,380	4,480	4,595	4,860	5,170	5,530	5,940	6,395
190	4,240	4,270	4,315	4,370	4,435	4,510	4,600	4,705	4,820	5,080	5,395	5,755	6,160	6,620
200	4,465	4,495	4,535	4,590	4,655	4,735	4,825	4,925	5,040	5,305	5,615	5,975	6,385	6,840

different authorities from 0.50 to 1.72 lbs., but more generally is taken at 0.80 lbs., equivalent to a grade of 0.04 per cent., and this figure has been taken in these calculations.

An abstract of the principal available information on this subject is given in Tables 5 and 6.

In Table 7 is given in tabular form the curve resistance and equivalent grades from 1 to 26 deg.

TABLE 5.—Train Resistance, Curve Resistance.

Authority.	Resistance, 1 deg. Equivalent grade, per cent.
Penn. R.R.—For low grade freight line.	1.00
" " —From engine entering curve to last car off curve.	0.80
" " —From last car on curve to engine leaving curve.	0.83
Max Wickhorst 7½ deg. curve.	1.72
Editorial comment: "Resistance generally underestimated."	
Union Pacific	0.80
Southern Pacific—For each degree below 7 deg.	0.80
Southern Pacific—For each degree above 7 deg.	1.00
Baltimore & Ohio	0.50
Wellington—1 deg. curve at 12 m. p. h.	1.00
" " " " " " " " " " " "	0.50
" " " " " " " " " " " "	1.00
" " " " " " " " " " " "	0.80
" " " " " " " " " " " "	2.00
" " " " " " " " " " " "	0.50
" " " " " " " " " " " "	1.00
" " " " " " " " " " " "	0.40
" " " " " " " " " " " "	0.60
Boston & Maine	0.50
Chanute, at Slip	0.1713
25 m. p. h. Flange friction	0.245
Loss at couplings	0.0213
	0.4387
"Coning increases curve resistance."	
W F (D + L)	
Morrison	
2 R	
W = weight.	
F = co-efficient 1 to .27 according to weather.	
L = length, rigid wheel base.	
R = radius of curve.	
D = distance apart treads.	
Max Wickhorst—7½ deg. curve	1.72
Editorial comment: "Resistance generally underestimated."	
G. L. Fowler "Rail pressure varies with speed" (on curve)	

*Slow speeds with freight trains. Curves 0 deg. 15 min. to 2 deg.

†American Engineering, 4/02.

‡"Railway Location," p. 911.

§Letter to the Railroad Age Gazette, April 1, 1909.

||"Friction and Lost Work," Thurston, p. 214.

*Unit of weight and measures are not specified.

†Manual of Locomotive Engineering, p. 79.

‡Railroad Gazette, November, 1907.

would seem increases materially with the length of rigid wheel base. The data on this subject are very incomplete.

TABLE 7.

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Degree of curve	1.	2.	3.	4.	5.	6.	7.	8.	9.
Radius of curve	5,730	2,865	1,910	1,433	1,146	955	819	717	637
Pounds per ton	0.8	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20
Equivalent grade:									
In per cent.	.04	.08	.12	.16	.20	.24	.28	.32	.36
In ft. per mile	2.11	4.2	6.3	8.4	10.6	12.7	14.8	16.9	19.0
Degree of curve	10.	11.	12.	13.	14.	15.	16.	17.	18.
Radius of curve	574	522	478	442	410	383	359	338	320
Pounds, per ton	8.00	8.80	9.60	10.40	11.20	12.00	12.80	13.60	14.40
Equivalent grade:									
In per cent.	.40	.44	.48	.52	.56	.60	.64	.68	.72
In ft. per mile	21.1	23.2	25.3	27.5	29.6	31.7	33.8	35.9	38.0
Degree of curve	19.	20.	21.	22.	23.	24.	25.	26.	
Radius of curve	303	288	274	262	251	240	231	222	
Pounds per ton	15.20	16.00	16.80	17.60	18.40	19.20	20.00	20.80	
Equivalent grade:									
In per cent.	.76	.80	.84	.88	.92	.96	1.00	1.04	
In ft. per mile	40.1	42.2	44.3	46.4	48.6	50.7	52.8	54.9	
Equivalent grade per degree of curvature = 2.11 ft. per mile, or .04 per cent. grade.									

CURVE RESISTANCE.

"For different wheel bases closely approximating standard practice the resistance would be:

TABLE 9.

Wheel base.	Resistance, lbs. per ton.	Wheel base.	Resistance, lbs. per ton.
5 ft.	0.4 + 0.380 D	12 ft.	0.4 + 0.625 D
6 "	0.4 + 0.415 D	13 "	0.4 + 0.660 D
7 "	0.4 + 0.460 D	15 "	0.4 + 0.730 D
8 "	0.4 + 0.485 D	16 "	0.4 + 0.765 D
9 "	0.4 + 0.520 D	20 "	0.4 + 0.905 D

NOTE.—D = curve in degrees.

"The materially greater resistance of locomotives is seen from this table. It will also be seen from the introduction of the constant term that the resistance per degree is less with sharp than with flat curves." ("Curve Resistance," Wm. G. Raymond, *Railroad Gazette*, August 17, 1906.)

(To be continued.)

Brussels has two main stations, both much over-crowded and hardly capable of enlargement. The government now proposes to build a central station for passengers only, and to connect it with both of the old ones by a railway partly elevated and partly underground, all at a cost of \$11,000,000. This project has been submitted to the Parliament.

ROADMASTERS' CONVENTION.

The twenty-seventh annual convention of the Roadmasters' and Maintenance of Way Association was begun at the Ebbitt House, Washington, D. C., Tuesday, September 14. After the meeting was called to order by President A. E. Hausen, David W. Lum, of the Southern Railway, delivered an address of welcome. In the routine business, which followed, 27 new members were elected.

The first report read was that on Best Method of Changing Rail or Laying New Rail on Steam Railways, by John Barth, supervisor of the Cleveland, Cincinnati, Chicago & St. Louis, at Mattoon, Ill. The following is an abstract of the report:

This report is made from actual experience in taking up 65 miles of 80-lb. rail and laying 90-lb. rail. To unload the new rail I used a rail unloader, which was operated by air, furnished by the work engine, which took a foreman and five men besides the train crew to operate. Any good handy man could run the loader. I made comparison with loading and unloading rail, and found that we could handle the rail considerably cheaper with the machine. It cost to unload the new rail and fastenings, per mile:

Labor	\$9.75
Work-train service	9.58
Fuel, oil and waste	7.58
Total	\$26.91

This was on single track where we had an average of 17 trains during the 10 working hours. We loaded the old rail with the rail loader, and it cost practically the same to load it as it did to unload the new rail.

In laying this rail I used gangs of one foreman, assistant foreman, timekeeper, two flagmen and 44 men. Had my gangs organized as follows: Six men with claw bars pulling spikes; three men with spike mauls to loosen up spikes that were stuck and to knock down stubbs; four men throwing out the old rail; one man with nipping bar to cant the old rails up out of the old bed, and three men to shove it out; three men driving plugs in the old holes, which should be distributed ahead of the work.

In taking up light rail and laying heavier rail, pull the outside spikes. In doing this have one man with an adze to adze off the very highest ties only and to cut off the plugs that stick up. Use 12 men with tongs to set in the new rail, which should be set in one rail at a time.

Have one good hustling fellow to put in the expansion shims and keep the rail gang moving, using steel-cut nails for shims, making the expansion according to what the thermometer shows it should, by using different sizes of nails, putting the nail in crossways against the ball, so that it will be out of the way in putting on the angle bars. After the first few trains this nail will slip out. Two men with bars with claws on one end and pointed on the other shove the rail into the spikes at center and quarters. Four men with spike mauls start off, leaving eight ties unspiked between each man, and then continue going, each man spiking every eighth tie from the last one that he spiked, which would spike every other tie, and would prevent the men running around each other. One man with a claw bar and adze pulls out the spikes that come in the way of the angle bars at the new joint, and adzes down the high ties at the new joint. Five men put on angle bars and bolt up, putting two bolts at each joint, all bolts and angle bars to be distributed ahead of the rail laying, each day's work only. Have plenty of wrenches and spike mauls, and when connection is being made, or waiting for trains, turn the men that are working in the tong gang and those throwing out rail back to full bolting and full spiking.

Two men with a push car to keep the connection rails, off-set splices and everything needed in making a connection, and extra tools, right up with the rail laying, so that when connection is to be made they will be on the ground. Have the spikers and bolters in starting out assist these two men in loading the connection rails. Always move the last new

rail ahead and use it as a connection rail all the way through. This will always give you a good joint.

The foreman should watch the time of the regular trains and go ahead of the spike pullers and pick out his place for making a connection, and have four picked men out of the gang that set in the rail to make the connection, using short pieces of rail. I used pieces from 4 ft. to 4 in. long. Used off-set bars from 90 lbs. to 80 lbs. I always found that my new rail fell short. I was putting down 33-ft. rail and taking up 30-ft. rail, and every 10-rail lengths we could make a good connection by pulling the 80-lb. rail against the 90-lb. and using short pieces of 80-lb. rail to fill in the gap. In closing up at night, if I thought it necessary, I would cut in a long piece of rail.

The two men handling the push car and keeping the tools and connections up with the rail laying should also keep the tools in good repair, such as keeping handles in the mauls, and have a general supervision of the tools.

The assistant foreman should be back on the work, and should see that the track is kept safely spiked and bolted and ready for trains by the time a connection is made. Section men should follow up and tamp any ties that may be hanging, or shim them up as the season of the year may require.

Gage the track when you space the ties, as you will have to do it at that time any way, and it avoids cutting up the ties with spikes. In taking up 80-lb. rail and putting down 90-lb. rail, pull the outside spikes of both rails. In doing this you avoid adzing, as the new rail will set up on the shoulder of the tie on the outside and give the wheels a full bearing on the ball of the rail. In taking up and laying rail of the same size, pull the inside spikes on both rails and adze the ties down so as to give the wheel a perfect bearing on the ball of the rail. To do this it would take five extra men above the 44 to do the adzing. Full bolt and spike the new rail and uncouple the old rail as far as you go each day. This usually can be done while waiting on trains. If not, take the time to do it. This is the reason I did not work larger gangs of men, as 44 or 46 men just about cleaned up each day's work even.

This rail laying cost \$134.24 per mile. We laid an average of 3,500 ft. of rail per day.

DISCUSSION.

This report was accepted as representing the best practice, except in the portion referring to the substitution of heavy for light rail. On motion, that portion was made to read: "When new rail is laid, pull the outside row of spikes on one side and both rows on the other side."

For the loading and unloading of rails on track, there was a variety of opinion. The hoisting engine, mounted on a flat car; the derrick car or the air hoist attached to the train engine air pump; drawing the rails out over an apron hung over the back of the car; or sliding the rails down a series of rollers attached to the sides of the car at different heights were presented as means of rail handling.

The following officers have been elected for the ensuing year: James Sweeney, president; Thomas Thompson, first vice-president; J. L. Fingle, second vice-president; W. E. Emery, secretary and treasurer. The next annual meeting will be held in Chicago.

EXHIBITS.

The railway supplies exhibited were many and varied, as the following list of firms represented indicates:

American Valve & Meter Co., Cincinnati, O.—Anderson's Economy switch stands and safety joint locks. Represented by J. T. McGarry and F. C. Anderson.

Buda Foundry & Manufacturing Co., Chicago.—Large and small motor cars for track inspection; track drills; jacks; tool grinders. Represented by F. E. Place, R. M. Smith, R. S. Bishop, T. H. Wheeler and J. L. Artmeier.

Coulter, C. J., & Co., Hammond, Ind.—Track wrench with drill attachment. Represented by C. J. Coulter.

Cambria Steel Co., Johnstown, Pa.—The 100 per cent. rail joint and the Morrison guard rail. Represented by A. Morrison.

Dilworth, Porter & Co., Pittsburgh, Pa.—Goldie claw tie plate and Glendon tie plate. Represented by William Goldie.

Dorpmueller Company, New York. Anti-rail-creeper. Represented by A. Dinklage.

Fairbanks, Morse & Co., Chicago.—Gasolene motor cars; Sheffield cattle guards and Sheffield No. 5 rail drill. Represented by A. A.

Taylor, J. A. Steele, R. A. Paterson, L. M. Condet and W. W. Adams. Foster, Frank M., M.E., Columbus, Ohio.—Foster interlocking switch stand. Represented by Frank M. Foster and George E. Kalb. Goldie, William, Jr., & Co., Bay City, Mich.—Goldie perfect tie plugs. Represented by William Goldie. Hayes Track Appliance Co., Geneva, N. Y.—Derails with operating and target stands. Represented by H. F. Nester. Kent, Edwin R., & Co., Chicago.—Star solid manganese steel frogs and crossings. Represented by J. T. Stafford. Milburn, Alexander, Company, Baltimore, Md.—Seven lights, ranging from 500 to 5,000 candle-power. Represented by A. F. Jenkins. Ramapo Iron Works, Hillburn, N. Y.—Numbers 17 and 20 high target positive and automatic switch stands; the J. B. Strong guard rail clamp. Represented by W. C. Kidd, Arthur Gemunder, W. B. Lee and F. C. Stowell. Rail Joint Co., New York.—Rail joints. Represented by F. C. Stowell, Charles Jenkinson and W. E. Clark. Railroad Supply Co., Chicago.—Tie plates. Represented by H. M. Buck. U. S. Wind Engine & Pump Co., Batavia, Ill.—Switch stands; semaphores; water supplies; also a breakable latch for switch stands.

BOILER PRACTICE IN EUROPE.

A recent report to the International Railway Congress, published in the *Bulletin*, takes up the subject of locomotive boiler practice in Belgium, Spain, France, Italy and Portugal, and gives some details showing the tendencies that are predominant in these countries. In comparing them with the practice of the United States, many familiar things will be seen, and yet it is curiously interesting that the European engineers seem to be having difficulty with details that have been established in America for years, and have given the best of satisfaction. This is especially true of the use of steel in fireboxes, which is just now coming to gain a real foothold. That trouble has existed does not seem to be wholly due to the possible fact that the best method of application was not known, or a suitable quality of steel was not used, because in some American-built locomotives, delivered to the Italian State Railway, it was stated that the results were not satisfactory. Still, we all know that the personal equation of likes and dislikes has much to do with the success or failure of a device or practice in this country and there is no reason to think that this should be different abroad.

As a general rule, the fireboxes are of copper, but a number of trials of steel are in progress. The Nord, of France, has lately fitted two locomotives of the older design with fireboxes made wholly of steel, but the application has not been in service for a sufficient length of time to make it possible to draw conclusions as yet.

The Midi has fitted a considerable number of locomotives with steel crown sheets and they are said to be giving good satisfaction. On the other hand, the Paris, Lyons & Mediterranean used some steel fireboxes a number of years ago that were discarded as unsatisfactory because of the cracking of the stayed portions.

During the past two years the French government system has been trying a composite firebox on two locomotives that are carrying pressures of 185 lbs. and 213 lbs., respectively. In these, that part of the tube sheet that receives the tubes is made of steel and the lower part of copper. These two parts are joined by a lap seam with the copper part towards the fire so that the seam can be calked and this is located just above the arch. These compound plates have, up to the present, given good results; leaks have, however, occurred at the seam which have been stopped by calking and this has made it necessary to replace some of the rivets. Finally, the Great Southern of Spain has had two boilers fitted with steel fireboxes for the past two years and these are reported as giving good satisfaction. So it appears as though the steel firebox was at last gaining a foothold in these countries and that in time it will drive out the copper construction just as it has in the United States.

The types of boilers used are divided between the Belpaire and the radial stay. The French railways are using the Belpaire on the greater portion of their work, but this holds for only a portion of the Belgian State Railway, where the Belpaire boiler originated, as these lines have only a few compounds with that type. The Spanish and Portuguese systems use both types and so also do many of the secondary railways.

Taken as a whole, however, it is the radial stay boiler that is the most extensively used. The use of crown bars has practically disappeared and they are only used on a few of the secondary lines. The advantages of the stay in the matters of lightness, ease of repairs and inspection and cleaning have been the controlling factors in the adoption. The practice of using one or more rows of expansion stays at the front is recommended as a relief to expansion stresses, and is the common practice. Attention is called to this in connection with the discussion at the last convention of the Master Mechanics' Association in which many doubts were expressed as to the utility of this form of stay.

As for the cylindrical fireboxes that were introduced into the United States several years ago, after they had been tried and discarded on the West Bank of the Rhine Railway, the simple statement is made, in the report, that they are not used at all, and the fact that after several years of use they do not seem to be gaining any great headway in the United States indicates that the theoretical advantages are greater than the practical, which, as in other things, is bad for the theory.

Firedoor practice naturally varies and there is no definite shape that is anything like a universal practice. A hinged door is, however, in universal use, but the shape runs from the round through the elliptical to the almost square. In the construction of the opening the two sheets are always connected by a riveted ring.

The relations between the grate area, air space in the fire-grate, as well as the total tube area, are taken up at length. The air spaces in the fire grate are, as a rule, equal to about half the total area of the grate; on some railways, this ratio varies between one-half and two-fifths; in some cases, it is reduced to 0.35, particularly if rocking grates are used. This type of grate, which is very common in America, is beginning to become more usual in Europe; the Orleans Railway has adopted it on its more recent locomotives and so has the French State Railway; the Midi and the Paris-Lyons-Mediterranean have equipped several locomotives with this device as an experiment. Rocking grates seem to give very good results; they make it easy to clean the fire while saving the fireman from the troublesome handling of the firing tools.

The total clear cross-section of the smoke tubes varies between a sixth and an eighth of the grate area. This cross-section can hardly be too large; increasing it reduces the speed of the current of hot gases and consequently reduces the amount of fuel (solid or gaseous) which is drawn over into the smokebox, without being burnt. The clear cross-section can be increased either by increasing the diameter of the tubes (for it is easy to see that with a given area of tube-plate, the cross-section of the tubes is increased by increasing the diameter), or by adopting the American "wagon top" form, by means of which the tube-plate of the firebox can be given a greater useful surface, better proportioned to that of the tube-plate of the smokebox.

The heating surface of the tubes varies between fifty and seventy times the grate area, if smooth tubes are used, and between sixty and eighty times the grate area, if *Serve* tubes are used. Increasing the heating surface of the tubes to beyond a certain limit (which, in the case of smooth tubes, can be fixed at about fifty to sixty times the grate area), is of a very little advantage as regards the efficiency of the boiler. In fact, even if the heating surface of the tubes is very much increased, all that can be attained is to reduce by some 50°, that is by one-sixth at most, the temperature of the hot gases in the smokebox, which varies normally, according to the intensity of the combustion, between 570 and 660 deg. Fahr. Now the heat lost by the gases in the smokebox represents about 15 per cent. of the total heat produced by the combustion of the fuel. If this loss is reduced by one-sixth, the amount of heat utilized, that is to say, the efficiency of the boiler, is only increased by 2.5 per cent.

Generally speaking, except in the case of Pacific locomotives

which are as yet few in number, the length of the barrel does not exceed 16 ft. 5 in. The smokebox is rigidly fixed to cross-bracing connecting the frame plates. On some railways the barrel has no other support, but most of them use intermediate supports which are formed either of flexible plate, according to the American plan, or of cross-bracing formed of steel castings, on which the boiler can slide. The plan is adopted, and with still better reason, on the Pacific locomotives, which have barrels about 19 ft. 8 in. long.

It may be asked whether, in the case of long boilers, the tubes, which are subject to vibration and to bending, do not require to be supported by an intermediate tube-plate. This has sometimes been done in the case of old locomotives, but it has been found to be useless. This uselessness is very definite if ribbed tubes are used, which are very stiff; smooth tubes having a greater outside diameter than 2 in. are also sufficiently stiff, and there is a tendency to use, in the case of long boilers, tubes having a diameter of at least $2\frac{1}{4}$ in.

Nearly all the railways use a drum-head tube-plate in the smokebox; this is riveted to the inside of the front ring of the barrel. Some, especially the Belgian State and the Andalusian, also use a plate with extension fitted to the barrel with an angle.

In the matter of the material for the tubes there seems to be a tendency to adopt iron or steel with a probable preference for the latter material. This does not mean that the brass tube is disappearing. Mild steel is being extensively used in France because it is cheaper than brass and produces a lower strain on the tubesheets because of the lower coefficient of expansion. Then, too, it has been found that brass tubes do not resist a pressure of more than 170 lbs. satisfactorily, while the firebox ends of such tubes are corroded very rapidly. At the same time it is acknowledged that steel tubes become corroded and pitted more quickly than brass if the water is bad; but, as a general rule, the water in France is good. Algiers, Italy and Belgium, on the other hand, still cling to the use of brass, though Italy is using iron or steel for long tubes. In Belgium the action of the expansion is avoided by giving the tubes a slight upward curvature and by the use of stays between the tubesheets.

It is, of course, well known that the weights of locomotives and consequently of the boilers is less in Europe than in the United States, which results in a shorter length of tube than that which has almost come to be considered as normal here. The Serve tubes, which have been used nearly exclusively on the French locomotives during the past ten years have a length that varies from 11 ft. 6 in. to 14 ft. 9 in. But some of the recent Pacific locomotives that have been built have tube lengths of 19 ft. 8 in., and these have an outside diameter of about $2\frac{1}{4}$ in. The external diameter of the Serve tubes is usually from 2 9-16 in. to $2\frac{3}{4}$ in. The older locomotives having smooth tubes seldom have lengths above 16 ft. 5 in., with an external diameter of about 2 in., which corresponds very closely with the practice in America.

In the application of the tubes they are sometimes contracted as much as 5-32 in. at the firebox and expanded $\frac{1}{8}$ in. at the smokebox.

The Serve tube is used almost exclusively on the French lines and it is also used extensively on the Italian roads, but, while it is generally recognized as giving good results in steam generation, there are a number of roads, such as the Eastern, Midi and Italian State, where it is considered as causing a rapid deterioration of the plate because of its rigidity.

In 1896 the Belgian State Railway tried Serve tubes on a number of Belpaire boilers, but the results were unsatisfactory as the tubesheets were deformed and cracked by the thrust of the tubes. Recently they have again been used on about sixty four-cylinder compounds with narrow fireboxes. In this case the tubesheets have been held together with stays and have stood well up to the present.

The tools used for fixing the tubes in the plates are the Dudgeon, the Caraman and the Boyer. They are sufficiently well known to make it unnecessary to give a description of them.

The holes have as a rule a taper of 1 in 40 or 1 in 50, and the drift of the tube expander has the same taper, so as to make a conical joint which helps to secure the tube to the plate. At the firebox end the expanding is generally done in two operations, one before and one after the beading of the tube end.

The order in which the tubes are successively set in varies much on different railways, and this seems to show that it is of no importance. On the French Eastern, the tubes are set in and expanded in horizontal rows, alternately from right to left and from left to right. On the French Northern, the work is done in vertical rows, starting from the middle, and then doing a vertical row on the right and on the left alternately, but always going from the top to the bottom; experience would show that this method, which tends to drive the metal towards the edges, is the best for avoiding deformations of the tube sheet. On the Midi railway, the work is done in horizontal rows, starting from the bottom. On the Paris, Lyons and Mediterranean, the work is done in vertical rows, starting from the extreme right or the extreme left row; but always starting at the top. On the Belgian State Railway no particular order is adopted.

Small importance need be attached to the order in which the tubes are set in, but the most rational procedure would seem to be that of the Northern Railway. If, however, it is advisable to drive the metal towards the side edges of the plate in order to avoid deformation, it would appear to be equally advisable to drive the metal towards the upper edge, and then the work should be done in vertical rows starting from the center and always from the bottom to the top.

The railways which use steel tubes do not use ferrules, while those which have kept to brass tubes apply ferrules in order to protect the end of the tube against the fire and to improve the tightness. The thickness of the ferrules varies between $\frac{3}{32}$ and $\frac{5}{32}$ inch; their taper is the same, or is a little greater, than that of the holes in the tube-plate. Ferrules have the great disadvantage that they materially reduce (at least by 10 to 12 per cent. in the case of smooth tubes) the clear cross-section available for the hot gases, and consequently the steam generation. On the other hand, they cannot be much depended on for increasing the tightness, for they easily work loose and get knocked out of place by the cleaning rods. As regards protecting the ends of the tubes, they are very efficient.

The steel tubes are nearly everywhere beaded over, at all events at the firebox end, and often also at the smokebox end. The bead at the end of the tube increases its strength, prolongs its life and protects the tube-plate of the fire-box against the direct action of the hot gases at the joint. As leaks always start at the edge of the holes, it is very important to protect this spot by beading over the tube end. Finally, such beaded tubes are much less liable to become clogged; soot and other solid particles are much less likely to collect there; such matter would tend to obstruct the tubes more or less, and would materially interfere with the passage of the hot gases and consequently with the steam generation.

In the case of brass tubes, the practice of beading is less general. On the Belgian State Railway, the brass tubes are beaded, while this is not done on the Italian railways and on most secondary railways. But the Italian railways have now for some time been trying ferrules with a flange, in order to protect the ends of the copper tubes against the flames, and this would show that such a protection is considered necessary.

Except on some of the Spanish railways the tubes are always arranged in vertical rows as it is the general impression that this is best for the disengagement of the steam. As for the

spacing, in the case of the $2\frac{3}{4}$ in. Serve tube the spacing is about $3\frac{1}{2}$ in., while for the smooth 2 in. tubes it is about $2\frac{5}{8}$ in., or closely comparable with American practice.

In France nearly all of the locomotives constructed during the past ten years or so have had a working pressure of from 213 to 228 lbs. per sq. in. Special means to cope with these pressures, especially in keeping the tubes tight and maintaining the firebox tubesheet are not taken. The Midi, in the case of its more recent locomotives, has connected the two tubesheets by stayrods with the tubes. Other roads outside of France are also using high pressures.

It has everywhere been observed that boilers with a higher pressure suffer sooner and require more maintenance than the old boilers whose working pressure was not more than 170 lbs. per sq. in. It may be asked whether this result is wholly due to the increase of pressure, or whether it is due to any other cause, at least partly and to an extent it cannot as yet be determined. For at the same time as the working pressure, the size of the firebox has also been increased, and that in one dimension only, namely longitudinally; for nearly all of the fireboxes are in between the frame plates and are consequently all of the same width. It is argued, then, that it is evident that increasing the dimensions of the firebox in one direction only has the effect of increasing the thrusts due to expansion. It consequently remains to be ascertained whether a large wide firebox, extending above the frames, and having a similar cubical content to the old fireboxes, will not be stronger than a large, narrow box. If this were so, it would show that the increase of pressure were only a secondary cause.

If, however, we take the testimony of American engineers who have increased the pressures in their boilers, without, in many instances making any change whatever in the dimensions, it appears to be very clearly settled that the increase of pressure has been responsible in itself, for a great deal of the increase in the cost of boiler maintenance.

As for the influence of the spacing of the tubes on the damage done to the tubesheets, it appears to be the opinion of a number of officers that this has no influence whatever, as far as the production of cracks in the corners is concerned. But it is generally recognized that it is well to do the flanging with as large a radius as possible and this has led to the placing of the outside rows of tubes and stays at some distance from the edge of the plates. It is also advisable, in order to avoid fractures of the interspaces between the tubes, to have the centers of the tubes as far apart as possible, or else to contract the ends of the tubes at the firebox tube-plate more than is usual; this also facilitates the circulation of the water and the disengagement of the steam, which is particularly brisk at the tube-plate. Most of the French railways, in the case of Serve-tube boilers, reduce by $\frac{1}{4}$ to $\frac{5}{8}$ inch the diameter of twelve to fifteen tube holes in each upper corner of the tube-plate.

Firebox tube-plates of copper are generally hammer-hardened by the cold hammering of the parts where the tubes enter; as a result, the tubes are held better, the tightening produced by the expanding being more effective.

The chief injuries in tube-plates are cracks in the corners and fractures in the interspaces. In order to repair the former, copper angles are applied after removal of the part damaged; in the case of the latter, screwed copper rings are put in, expanded and beaded over; if the fracture extends from one hole to another, either an 8-shaped piece is applied, or else a stud is screwed into the damaged place before the copper rings are put in.

Several railways use the Ragno system. In this a thin copper sheet $\frac{3}{32}$ to $\frac{1}{4}$ in. thick, is placed on the inside of the tube-plate to which it is shaped, and is kept in place by ferules placed in the tube holes and beaded over on both sides.

The length of the smokeboxes of the newer French locomotives varies between 5 ft. $10\frac{1}{4}$ in. and 6 ft. $10\frac{5}{8}$ in. The

smokeboxes on some older locomotives have been made larger. The smokeboxes of the Belgian State Railway have a maximum length of 6 ft. $2\frac{1}{8}$ in. Most of the foreign railways also have smokeboxes of large size.

This increase of capacity has the advantage of making more uniform the vacuum produced by the exhaust, of giving the hot gases a large cross-section for their passage while at the same time making it possible to reduce the size of mesh or the clear spaces between the wires of the metal screens used to arrest sparks, and of providing room for the cinders to settle without obstructing the lower tubes.

All the locomotives have steam domes, even the Pacific locomotives which have the center line of their boilers 9 ft. 6 in. above rail-level.

As a rule, the insulating material simply consists of a layer of air; the boilers are surrounded everywhere, except at the lower part of the firebox beyond the frame plates and below, by thin sheet supported on a light frame, 35 to 40 millimeters ($1\frac{1}{8}$ to $1\frac{1}{4}$ in.) from the surface of the boiler.

A certain number of railways have made trials of lagging.

The French Eastern tried, in 1872, cork lagging and also slag-wool lagging; in 1887-1889, an asbestos lagging which was used on eighty-four locomotives; in 1890-1892, a silicate-cotton lagging which was used on sixteen locomotives. The conclusion drawn from these trials was as follows: "Taking into consideration the small saving which one can hope to effect and the disadvantages which such lagging presents as regards the maintenance of the boilers, it is advisable to give up fitting locomotives with such non-conducting coverings."

The French Northern has, as a trial, used asbestos lagging on two 4-4-0 compounds of the latest type and on a tank locomotive, with six coupled wheels, of the Ceinture Railway. These laggings, when examined sixteen and twenty-four months afterwards, were found to be in good condition. But it was not possible to determine the saving owing to the difficulty of disentangling all the other factors which have a more material effect on the consumption. These solitary applications have not been extended. The use of lagging has disadvantages if the boilers are washed out with cold water. As the boiler cools more slowly, there may not be time available to wait till it is quite cold. Now, as we have seen above, this is one of the causes of leaky tubes.

The Midi is at present making trials with a lagging consisting of magnesium carbonate. The saving in fuel resulting from the use of such lagging is stated to be 2 to 3 per cent.

The Paris-Lyons-Mediterranean is trying various kinds of lagging, but states that it has as yet not determined their value.

The Italian State Railway is also trying various laggings: magnesia, white asbestos, blue asbestos from the Cape.

The Belgian State Railway uses, as a general rule, a non-conducting covering consisting of asbestos matting covered over with thin sheet iron. The back of the firebox is protected by boards with a coat of silicate paint, also covered by thin sheet iron. On some tank locomotives, the inside of the roof of the cab is also lined with boards.

Comparative trials made with locomotives with asbestos lagging and locomotives with simple sheet-iron lagging, have not made it possible to determine the saving in fuel. It has, on the other hand, been observed that locomotives with lagging take on the average three hours longer to cool than those which have no lagging.

The conclusions that are drawn from the report, as far as France, Belgium, Spain, Italy and Portugal are concerned, are that the tendency is still towards the retention of copper fireboxes; the use of stays rather than crown bars for the fireboxes; the introduction of the rocking grate; the adoption of steel tubes, except where the water is bad; a fall in favor of the Serve ribbed tubes and the application of means to reduce the leakage of the tubes in the tubesheet without any definite results having as yet been obtained.

General News Section.

The Chicago & North Western has completed the installation of telephones for train despatching between Chicago and Milwaukee.

F. A. Delano, president of the Wabash, addressed the Electric Club of Chicago on September 15 on "A Plan for a New Union Passenger Railway Terminal for Chicago."

A telephone train-despatching system was put in service by the Gulf, Colorado and Santa Fe on September 2 between Temple, Tex., and Cleburne and between Cleburne and Gainesville, Tex.

On the morning of September 7 fourteen spans of the bridge of the Fort Worth & Denver across the Canadian river at Tascosa, Tex., were washed away by a flood, the river rising 7 ft. in 50 minutes.

A movement has been started in Indiana among locomotive engineers to bring about the passage of a law to create a state inspectorship for locomotive boilers, to be copied after the New York law.

It is estimated that the damage to the railways of Mexico from the recent floods has amounted to \$3,000,000. On the Monterey-Matamoras line over 100 miles of track and 18 bridges are said to have been washed away.

The Indiana State Board of Forestry has issued a notice to all the railways warning against setting forest fires, and citing the section of the law which provides a penalty of from \$5 to \$50 for setting fire to forest lands within the state.

According to the report of the Southern Demurrage and Storage Bureau (headquarters at New Orleans) for the month of July the collections for storage at the stations reporting to that bureau were about three-fourths as large as the collections for demurrage; demurrage, \$10,277; storage, \$7,606.

The Cunard steamship "Mauretania," reaching New York from Liverpool on Thursday afternoon, September 9, made the distance from Daunt's Rock to Ambrose channel lightship in four days, eleven hours and thirty-five minutes, or seven minutes quicker than the record made by the "Lusitania" a week before.

The Forester's department of the Department of Agriculture has lately completed an estimate of the amount of timber standing in the Sitgreaves National Forest in east central Arizona, and reports that the work of estimating was done at a cost of 8 mills an acre. The estimating was done by a party of five timber experts, with a cook and a teamster, all in charge of D. W. Adams.

It is reported that three railway schools are to be established in Mexico with the approval and partly under the auspices of the National Railways of Mexico. The purpose is to give the students a thorough grounding in the fundamentals of mechanics, train handling and locomotive operation. The newspapers say that the schools are part of a systematic plan to fit native Mexicans to fill positions now held by men from the United States.

The project for a union passenger station at Memphis, Tenn., appears to be further postponed than ever, a conference of the governor of the state and other public men with the officers of the city and of the railway companies last week having failed to reach any agreement. The Illinois Central, the Louisville & Nashville and the Southern have under consideration plans for separate and independent stations, but nothing definite seems to be known as to when these plans will be carried out.

All trains were stopped for a brief period and business was suspended on the Union Pacific-Southern Pacific lines and the Illinois Central on Sunday, September 12, at the time of the beginning of the funeral services of President E. H. Harriman at Arden, N. Y. The Illinois Central office building and the Harriman Lines ticket offices in Chicago, as well as commercial

agencies of the roads throughout the country, were draped in mourning on Friday, September 10, and the Union Pacific-Southern Pacific offices throughout the West were closed all day Saturday.

The Pennsylvania Railroad's school of telegraphy at Bedford, Pa., established in 1907, has had 218 students and 117 of them have graduated. J. B. Fisher, superintendent of telegraph at Philadelphia, is in charge of its operation, with C. F. Emerick as resident manager. A large number of students is expected this fall. Students are instructed in the general duties of an agent in administering the affairs of a station. The time required to complete the course is from six to eight months, and immediately upon its completion graduates are provided with salaried positions in direct line of promotion. The bulk of the expense of the school is assumed by the company, as the cost of the course to the student, \$2 monthly, is merely nominal.

The Ganz steam motor car tested by the Chicago, Rock Island & Pacific with unsatisfactory results about a year ago has been returned to the road fitted with a new Ganz engine of lower steam pressure and a new Baldwin boiler and superheater. A party of officers of the Rock Island and other western roads made a trial trip on the car out of Chicago on September 14, and it will shortly be put in service on one of the branch lines. The car was built by the Railway Auto Car Company, weighs 53 tons and seats 48 passengers. The engine is 250 h.p. capacity. In order to secure comparative information of the performances of the various kinds of motor cars being tested, several cars will each be tried for a time on various runs in turn.

The city of New York proposes to make a little experiment in municipal operation of street cars. The run will be over the Queensboro bridge, length two miles, and the fare will be 3 cents one way, or 5 cents for the round trip. Owing to the delay in getting the approval of the Public Service Commission, or in settling the question of the jurisdiction of that body, it has been impossible thus far to close a contract with any of the city railways for running cars across the bridge, and, as a temporary expedient, electric motor omnibuses have been running. These are to be superseded by the municipal street car line as soon as arrangements can be made. It is proposed to hire cars from the South Shore Traction Company and to use electric current furnished by the New York Edison Company.

Four new observation passenger cars containing some novel features were placed in service on the Denver Limited trains of the Burlington on September 12. They are called "compartiment lounging cars." The platform is almost entirely enclosed by movable glass windows, which in fine weather may be raised on either side at the desire of the passengers. This compartment is wainscoted to a height of two feet in rose mahogany. There is no rear step, but there is a glass door in the center of the end. The front end of the car contains a buffet smoking room seating nineteen passengers and is separated from the ladies' parlor, accommodating twenty-one passengers, by a small library and writing room. The library will include Dr. Elliot's "five feet of books," with the addition of the Bible and Shakespeare and current magazines.

The Pennsylvania Railroad will comply under protest with the order of the Interstate Commerce Commission requiring a general balance sheet statement and prescribing the treatment of expenditures for additions and betterments. The Pennsylvania has written to the commission making protest, but at the same time gives notice that its accounts will be kept in accordance with the rules laid down by the commission. It is expected that the matter of this classification of expenditures will be fought out in the courts. The particular point at issue pertains to the rule that expenditures for additions and betterments shall in no case be charged to operating expenses, and further to the fact that it is no longer per-

missible to charge such expenditures to income, to profit and loss, or to special funds in such a manner as to exclude them from the property accounts in the balance sheet statement.

Faster Time on Western Roads.

The threatened speed war between the Western railways, induced by the announcement of the Burlington that it would no longer observe the Western speed agreement of two years ago, and that it would cut two hours from its running time from Chicago to Denver, took shape during the past week in the form of reductions in the schedules of trains running between Chicago and the Pacific coast by the Northwestern, the Union Pacific, the Chicago, Milwaukee and St. Paul and the Rock Island. On the Northwestern-Union Pacific line the reductions were made effective September 12. The Oregon-Washington Limited, which formerly left Chicago at 11:30 a.m., now leaves at 10 a.m. and reaches Portland at 8 a.m. of the third day; eastbound this train will leave Portland at 6:35 p.m. and reach Chicago at 8:35 p.m. of the third day. The Colorado Special, which left Chicago at 10 a.m. and reached Denver at 2 p.m., will leave Chicago at 1:30 p.m. and arrive at Denver at 4 p.m. the next day. Eastbound, the Colorado Special, which formerly left Denver at 2:45 p.m. and arrived at Chicago at 9:15 p.m., will leave Denver at noon and arrive in Chicago at 4:30 the next afternoon. The Overland Limited, which left Chicago at 5 p.m. and arrived in Denver at 9:30 p.m., will not leave Chicago until 7 p.m. and reaches Denver the same time as before, and it will also reach San Francisco at 7:28 p.m., the same as now. Eastbound, the Overland Limited, which formerly left San Francisco at noon, will leave there at 10:40 a.m., and will leave Denver at 8:15 a.m., instead of 7:20 a.m., as at present, and arrive in Chicago at 12:45, instead of 1:45 p.m., as now.

The Chicago, Milwaukee and St. Paul has reduced the time of its passenger trains between Chicago and Omaha to twelve hours, and the time of its Denver train in connection with the Union Pacific runs between Chicago and Denver in twenty-seven hours, thirty minutes. The Colorado Special will leave the Union Station, Chicago, at 1:30 p.m., instead of 10 a.m., and the Overland Limited will leave at 7 p.m., instead of 5 p.m.

The Rock Island changes were made effective September 12 and are as follows:

The Rocky Mountain Limited will continue to leave Chicago at 9:30 a.m. daily, but will arrive in Denver and Colorado Springs at 12:55 p.m. the following day, instead of 2:15 p.m., as at present. Eastbound, this train will leave Colorado Springs and Denver at 9 a.m., instead of 10:30 a.m., as at present, arriving in Chicago at 1:59 p.m., instead of 4:59 p.m., as at present.

Kansas City Union Station Ordinance Passed.

At a special election held September 9 in Kansas City, Mo., 26,368 votes were cast in favor of the proposition to grant the Kansas City Terminal Company, which is to build the new union station and terminals at a cost of about \$30,000,000, a franchise for 200 years, and only 700 votes were cast against the proposition. The Terminal company has sixty days to accept the terms, and it is expected that work will be started soon after that time. The voters also approved an ordinance authorizing the Park Board to sell to the Terminal Company certain lands needed for the widening and improving of the present Belt Line, and others for a change in the grade of Ninth street from Denver avenue to the east line of Hardesty avenue; change of grade on Hardesty avenue from Seventh street east from Denver avenue to Tenth street, and on Kensington avenue at Thirteenth street.

Long Island Trains to Manhattan December 1.

New York City newspapers have announced within the past week that the station of the Pennsylvania Railroad at Seventh avenue and Thirty-second street, Manhattan, would be so far completed by December 1 next that trains from the Long Island road, passing through the East river tunnels, would use

the station on and after that day. President Peters, of the Long Island, names January 1 as the day. Plans have been made to run electric trains from Jamaica to Seventh avenue every five minutes during the morning hours and at less frequent intervals at other parts of the day. Fifty cars are being built for the service. Officers of the Long Island estimate that suburban passengers from Jamaica and points east of there will save 20 minutes in the morning and 20 minutes in the evening, the time from Jamaica to Seventh avenue being 18 minutes.

The franchise under which the tunnels under the East river and Manhattan are operated prohibit "local service," so that no stops will be made by these trains between the Sunnyside yards, three or four miles east of Long Island City, and the western terminus of their runs at Seventh avenue. Passengers from Long Island City and those coming into Long Island City by the trains will cross the East river by the ferryboats as at present. By next summer the Long Island company expects to have the whole of the Rockaway, the North Shore and the Jamaica divisions electrified. Westinghouse, Church, Kerr & Co., the contractors for engineering work at the Pennsylvania station, have filed with the city department plans of the tracks in the Seventh avenue station and of the four signal cabins which are to be built there.

J. C. Stubbs on the Situation.

J. C. Stubbs, vice-president and traffic director of the Union and Southern Pacific, asked regarding the Harriman-Hill storm cloud, said: "As is well known we have an agreement with the Northern Pacific for the use of the recently double-tracked line between Portland and Tacoma. Contrary to the impression that this agreement may be terminated at any time I may say that it is to run for 99 years at least, which makes it to all intents and purposes a perpetual agreement.

"The Northern Pacific is perfectly willing that we shall use its tracks on condition that we do not interfere with its own schedules. We are building a tunnel from South Tacoma to our property in the northern part of the city, where we enter by the Tacoma-Seattle line owned jointly with the St. Paul. This tunnel may not be completed within a year.

"* * * This agreement shows that there is no disposition on the part of the Hill and Harriman interests to carry on any bitter warfare for territory."

Asked regarding the Deschutes Canyon branch projected from The Dalles, Oregon, south into the center of the state, Mr. Stubbs said: "I understand the report that there is room for but one railway in the upper half of the Deschutes canyon is false. I believe there is sufficient room for a half dozen lines there, and we are building into central Oregon without delay. Of the projected low grade cut-off between Weed, Cal., and Eugene, Ore., the section to Klamath Falls has been completed for some time, and construction toward Eugene is now in progress. Buckboard and horseback surveys have been made from Klamath Falls northeasterly across Oregon to Ontario on the Oregon Short Line on the Idaho border, and I presume that this line, some 300 miles long, will be constructed so soon as the Southern Pacific believes that it is called for."

As to the report that the Northern Pacific intends to extend its Deschutes Canyon line south and west to Coos Bay Mr. Stubbs said: "I do not believe that there is any foundation for it. The outlook for traffic in this district is not such as to warrant much competition. We have already put in several months of construction work on a line to extend from Drain, Ore., to Coos Bay, and this line will be completed eventually. I am a little skeptical about the traffic value of this territory, including the Portland-Seattle connection, when the traffic is divided among two or three roads."

As to the report that the Hill interests are about to close the Cheyenne gap in the Colorado & Southern and that a line is to be constructed northwest from Guernsey to meet the Northern Pacific in southern Montana, Mr. Stubbs said: "There is nothing in that story so far as I can see. * * * The C. & S. gap into Cheyenne will be closed. But Hill already has the Burlington, which cuts diagonally northwest to the Northern Pacific, and even if he could regain the whole of the Oriental cotton trade [which is what the gossips want

this line built for] it is my opinion that he would lose money on it, as the goods concerned are of low grade and not profitable freight."

As to the recent offer made to the government by the Hill management to put on a mail train that would cut the running time between Chicago and Portland from 72 to 62 hours, Mr. Stubbs said that the Harriman lines could cut charges and running time to a point that cannot be approached by any other road in their territory. " * * * We have not put millions of dollars into the improvement of our properties for nothing, as the other roads will discover if they inaugurate a speed war. * * * A big wheat crop is safely harvested. After the 20th of this month a mammoth corn crop will be a certainty. Although cotton has been interfered with by the spread of the boll weevil in Louisiana and by drought, the cloud cast by the cotton situation over the general outlook is no bigger than the hand. The outlook from the traffic standpoint has never been so satisfactory as it is now."—*Wall Street Journal*.

Oklahoma Farmers in New England.

A press despatch from Guthrie says that representatives of the farmers' unions in Oklahoma, Texas, Arkansas and Louisiana are to make a tour of the good road sections of the New England states as the guests of B. F. Yoakum, chairman of the executive committee of the Rock Island-Frisco.

They are to leave Oklahoma City on a special train this week and their journey will take about three weeks. In the Oklahoma delegation will be J. P. Conners, president of the state board of agriculture. At Washington the delegates will see the secretary of agriculture, who has promised to send with them a government road-building expert. After the good roads systems are viewed, a day or two will be spent on Mr. Yoakum's farm, on Long Island.

An Aerial Trolley Line—Without the Railway.

The project for an airship freight line between New York and Boston appears to have been held up—assuming that it was ever near enough to the earth to be susceptible of such treatment—but whatever its present condition its projectors will hide their heads when they read of what is proposed in Germany. Over there they make real estimates, on real blackboards with real chalk. The American consul at Chemnitz tells about the scheme:

"A well-known engineer of Marburg has combined the essential elements of the dirigible balloon and the electric railway—cars supported by the buoyancy of a balloon and motive power transmitted by an electric cable, the latter being the only feature of an ordinary electric road that is retained. The supporting balloon is cylindrical in shape, of semi-rigid construction, 200 ft. long and 33 ft. in diameter. It rests lightly against cables on either side, channeled wheels attached to the framework of the balloon forming the contact, the cables being suspended at the proper height by towers. The passenger car is attached below.

"A company is about to construct a line from the railway station in Marburg to Frauenberg, an elevation five miles distant and 1,200 ft. above the town. It is estimated that the cost of maintenance and of transportation will not exceed 3 per cent. of the corresponding expense on a railway through the avoidance of weight (?), friction and wear of material."

Union Pacific Directors' Resolutions.

The special committee of the board of directors of the Union Pacific, composed of Messrs. Hughitt, Frick and Peabody, appointed to prepare suitable resolutions on the death of E. H. Harriman, reported the following resolutions, which were unanimously adopted:

"Resolved, That the board with deep sorrow records the death of Edward Henry Harriman. * * * He was more than chairman of the executive committee and president, which offices, at the time of his death, he held and had long filled—he was the genius of the new Union Pacific and South-

ern Pacific; and the high state of efficiency to which these properties have been brought, the part that is being performed by them in the development of the country they serve, and the solid bases upon which the securities of said companies now rest, are monuments to his genius, marvelous energy, and untiring work in the interest of these companies.

"It is impossible to here record any adequate expression of appreciation of Mr. Harriman's work for the American railway system, for it must form a large and important chapter in the history of our times. But we who were intimately associated with Mr. Harriman appreciate even more the qualities which were less conspicuous to the public. The kindness of his heart, the strength of his friendship, the quickness of his sympathy and his loyalty to all his associates were traits of his character so marked as to inspire the devotion of all who knew him well, and his happiness in his home circle was an inspiration and delight. We deeply mourn his loss as a personal friend and as the head of these companies, and tender to his family our profound sympathy. * * *

New York City Rapid Transit.

The New York State Public Service Commission, first district, is considering plans for a four-track express and local subway from the lower end of Manhattan, northward, through Hudson street and Eighth avenue, to Fifty-ninth street, and thence eastward through Fifty-ninth street and across the Queensboro bridge to Jackson avenue, Long Island City. Such a line would pass close to the new Pennsylvania Railroad station at Eighth avenue. Before reaching the bridge the line would emerge from the ground and be made elevated over the bridge, and also over that part extending beyond the bridge, if such part should be built.

Chicago Subway.

Following the death of E. H. Harriman the stock of the companies controlling the Chicago freight subways suffered serious declines in the Chicago and New York markets, and it appears that Mr. Harriman and J. Ogden Armour have been sustaining the enterprise by paying the interest on its bonds. It is said that they have advanced about \$12,000,000 to the Chicago Subway Company, which controls the Illinois Tunnel Company. The business done in the tunnels is increasing, but the income is still far from sufficient to pay the interest on the bonds.

The Hine System of Organization.

The Utah division of the Oregon Short Line has adopted the "Hine" system, making the fourteenth road or division on which it is now in effect. The following five officers, namely, S. E. Canady, assistant superintendent; H. J. Harris, division engineer; Geo. Ross, master mechanic; O. B. Chalmers, trainmaster; F. A. Leute, chief dispatcher, have all been appointed assistant superintendents and the four other titles are abolished. Each officer continues charged with the responsibilities heretofore devolving upon him, and in addition assumes such other duties as may from time to time be assigned. A. B. Stevenson is superintendent of the Utah division.

Ship Building.

In August there were built in the United States and registered by the bureau of navigation 84 sail and steam vessels. Of these, 10, with a gross tonnage of 1,037, were wood sailing ships; 66, with a gross tonnage of 2,701, wood steam; two, with a gross tonnage of 1,066, steel sailing, and six, with a gross tonnage of 12,557, were steel steam ships. The total tonnage was 17,361. The two largest vessels were the steel steamers J. S. Ashley, 6,361 tons, and the Hector, 5,451 tons.

International Association of Ticket Agents.

The president of this association is H. E. Smith, Geneva, Ill.; secretary, J. V. Frazee, Philadelphia, Pa.

American Association of General Passenger and Ticket Agents.

The fifty-fourth annual convention of the American Association of General Passenger and Ticket Agents began on Tuesday morning, September 14, at the Hotel Secor, Toledo, Ohio. Reports from the following standing committees were scheduled to be heard: Association Ticket Paper, Standard Ticket Contracts and Joint Committee of Passenger Agents and Accounting Officers.

International Association for Testing Materials.

Dr. Charles B. Dudley has been elected president. The next congress will be held in America, probably in 1912. The total membership, in May, 1909, was 2,160, Germany having the largest number, 375, and the United States being second, with 290.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.
 AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa. June, 1910; Niagara Falls, Ont.
 AMERICAN ASSOC. OF LOCAL FREIGHT AGENTS' ASS'NS.—G. W. Dennison, Penna. Co., Toledo, Ohio.
 AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th St., New York; second Friday in month; New York.
 AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York, Nov. 17; Chicago.
 AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M., Concord, N. H.; Oct. 19, 1909; Jacksonville, Fla.
 AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, Monadnock Bldg., Chicago. March 14-17, 1910; Chicago.
 AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis; second Tuesday, May; Memphis, Tenn.
 AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago.
 AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. Edgar Marburg, Univ. of Pa., Philadelphia.
 AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and August; New York.
 AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., N. Y.; 2d Tues. in month; annual, Dec. 7-10; New York.
 AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 W. 39th St., New York; Oct. 4-8; Denver, Colo.
 ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago. June 29, 1910; Colorado Springs.
 ASSOCIATION OF RAILWAY CLAIM AGENTS.—E. H. Hemus, A. T. & S. F., Topeka, Kan.; May; Nashville, Tenn.
 ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Wisconsin Central Ry., Chicago. May 16-20, 1910; Los Angeles.
 ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Place, N. Y. Dec. 14-15; Chattanooga.
 CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
 CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.
 CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
 FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R. R., Richmond, Va. June 15, 1910; California.
 INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.
 INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago.
 INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; May; Cincinnati.
 IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month; except July and August; Des Moines.
 MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago.
 NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in month, ex. June, July, Aug. and Sept.; Boston.
 NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
 NORTH-WEST RAILWAY CLUB.—T. W. Flanagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, August; St. Paul and Minn.
 RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month; except June, July and August; Pittsburgh.
 RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.; Oct. 12-14; Louisville, Ky.
 RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.
 ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.
 ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
 SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Norquist, Chicago.
 SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—J. H. O'Donnell, Bogalusa, La. Oct. 21; Birmingham, Ala.
 SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., April, Aug. and Nov.; Atlanta.
 TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R. R., East Buffalo, N. Y.
 WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, 199 Chestnut St., Winnipeg; 2d Mon., ex. June, July and Aug.; Winnipeg.
 WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.
 WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

Traffic News.

The Louisville & Nashville has established a new daily through package car service from St. Louis, Mo., to Decatur, Ala. Cars will make second morning delivery.

One hundred and twenty-three automobiles were recently shipped in one trainload from Detroit to Minneapolis. The shipment required forty-one 33-ft. cars, three automobiles to a car.

The Kansas City-Missouri Navigation Company has been incorporated at Jefferson City, Mo., for the purpose of running freight and passenger steamers on the Missouri river and its branches.

Through passenger trains are now running between New Orleans, La., and Houston, Tex., over the St. Louis & San Francisco line, the first trains having started from each city on the morning of September 1.

It is announced that a total of 309,000 passengers passed through the union station at Seattle during the month of August. Various overland trains on the Northern Pacific carried 89,000 passengers and the coast lines 220,000.

The Grand Trunk Pacific, which will bring a good deal of grain into Winnipeg from the West this fall, has made an agreement with the Canadian Northern by which all such grain will be sent east to the head of navigation over the C. N.

The Missouri & North Arkansas has applied to the federal circuit court at Little Rock, Ark., for an injunction to restrain the Arkansas Railroad Commission from enforcing, as far as this road is concerned, the state 2-cent fare and passenger law, and the commission's distance tariff of freight rates. The hearing has been set for October 4.

A preliminary meeting of members of the Official Classification Committee will be held at the rooms of the Central Freight Association, Chicago, September 21, to hear oral arguments in favor of petitions presented for changes in the classification, which are to receive consideration by the committee at its October meeting in New York City. The object of this meeting in Chicago is to give petitioners who have applications pending before the committee an opportunity to be heard, if they so desire, without the necessity of going to New York.

A rehearing of the case of the Corn Belt Meat Producers' Association of Iowa against the railways of the state was held in Chicago on September 8 before Mr. Prouty, of the Interstate Commerce Commission. The case involved charges of discrimination in the rates on live stock from interior Iowa points to Chicago, on which reductions were ordered by the commission about a year ago. The rehearing was granted on complaint of the shippers that the order of the commission had not been fully observed by the railways. The roads were ordered to submit to the commission at Washington a schedule of group rates which will be considered before a decision is reached.

R. A. Love, vice-president and general manager of the Concho, San Saba & Llano Valley Railway, which is under construction, has asked the Railroad Commission of Texas to promulgate a tariff for this road between Miles, Tex., and Shawnee, a distance of about 10 miles, over which part of the line, he states, trains will be operated in September. He said that 16 miles of rails had been laid and the road will be pushed to completion. San Antonio and Llano, he stated, are the points to which it is now expected to build, but the road may be built to San Angelo and Kerrville if San Antonio does not accept a proposition to furnish the road with terminals and right of way and to take \$500,000 of its bonds.

Officers of the Missouri Pacific are quoted in the newspapers as reporting a marked increase in freight traffic throughout that company's lines. A fast freight service has been established from New York to Kansas City and other western points over the Delaware, Lackawanna & Western, the Wabash

and the Missouri Pacific. The Missouri Pacific has been delivering cars from New York at St. Joseph, Mo., in four days. These through cars from New York, which began running last May, are now carrying from 350 to 450 tons a month. This statement apparently refers to St. Joseph alone. The Missouri Pacific's freight runs from New York altogether are said to aggregate nearly 5,000 tons a month, 14 cars a day being run.

The New York World has been printing copies of letters tending to show that for several years, 1904-1906, and perhaps later, a number of railways leading west from the Atlantic seaboard paid rebates to the Holland-America steamship line, and it is said that the facts presented will be laid before the Federal grand jury with the charge that the rebates were illegal. The papers published consist mainly of letters written by officers of the steamship company concerning commissions paid to the steamship line by the railways on westbound import freight shipments. The Central Vermont, the New York, Ontario & Western, the New York Central, the Baltimore & Ohio, the Wabash, the Erie and the Chesapeake & Ohio are named.

The hearing before the Interstate Commerce Commission on the complaint of the Salt Lake City Commercial Club against the rate adjustment into Utah of the transcontinental railways is set for September 22 at Salt Lake City. The evidence will be heard by Commissioners C. A. Prouty and E. E. Clark. On September 29 these commissioners will go to Spokane to take evidence on the supplementary petition in the Spokane rate case filed by the Spokane chamber of commerce. Arguments in this case will be heard by the entire commission on October 4. The cities of Walla Walla, Wash., and Pendleton, Ore., have entered the case as interveners. From Spokane the commission will go to Seattle, Portland and San Francisco, conducting hearings about a week apart.

An order granting the Interstate Commerce Commission an appeal to the United States supreme court from the decision of the United States circuit court for the seventh district enjoining the commission from enforcing its order in the Missouri river rate case was entered on September 13. In the assignment of error filed by District Attorney E. S. Sims and Luther M. Walter, attorney for the commission, it is held that the court erred in holding that the commission was without power to make the order enjoined. Twenty items of error are cited. It is held that according to the provision of the ex-pediting act, in the absence of a unanimous opinion, the court should have certified the entire case to the supreme court, just as if the appeal had been taken without prejudice. It is denied that there was no inquiry by the commission respecting the reasonableness of the rates, as stated in the decision of the court.

Crop Conditions.

According to estimates made by the department of agriculture crop conditions in the United States, in the aggregate, declined during August, 1909, about 6.9 per cent., which compares with a decline in August last year of 4 per cent., and an average decline in August of the past ten years of about 3.2 per cent. On September 1 general crop conditions (including crops harvested before August 1, with their condition at time of harvest) were about 2.6 per cent. lower than on September 1, 1908, and 2.9 per cent. lower than the average condition on September 1 of the past ten years. As a consequence of the unfavorable August, general prospects were changed from above average on August 1 to below average on September 1. Compared with the ten-year average condition, which is represented by 100, the condition on September 1 of important crops was: Spring wheat, 115; oats and grapes, 105; flaxseed, 103; rye and potatoes, 101; hops, 100; hay, 99; tobacco, 97; barley, 96; rice, sweet potatoes and sugar cane, 95; buckwheat, 94; corn, 93; sorghum, 90; cotton, 87; apples and peaches, 80.

Compared with conditions on September 1, 1908, and the ten-year average conditions on September 1, respectively, the conditions, on September 1, 1909, in the aggregate, in the New England states were 10.2 per cent. and 9.2 per cent.

below; in the South Atlantic states 5.2 per cent. and 2.6 per cent. below; in the South Central states 19.1 per cent. and 15.8 per cent. below; in the North Central states east of the Mississippi river (comprising Ohio, Indiana, Illinois, Michigan and Wisconsin) 8.8 per cent. and 4 per cent. above; in the North Central states west of the Mississippi river 3.1 per cent. and 0.1 per cent. above; in the far Western states 7.7 per cent. and 5.0 per cent. above.

The following tabulation is a summary for the United States of crop conditions on September 1, with comparisons:

Crops.	Condition September 1—			August 1, 1909.
	1909.	1908.	10-year average.	
Corn	74.6	79.4	80.6	84.4
Spring wheat	88.6	77.6	77.0	91.6
Oats	83.8	69.7	79.8	85.5
Barley	80.5	81.2	83.7	85.4
Rye (yield, bushels)	16.0	16.4	15.8	....
Rye (quality)	92.9	92.7	91.4	....
Buckwheat	81.1	87.8	86.4	86.3
Flaxseed	88.9	82.5	86.2	92.7
Rice	84.7	93.5	88.7	84.5
Tobacco	80.2	84.3	82.7	83.4
Hay (yield, tons)	1.41	1.52	1.43	....
Hay (quality)	93.0	94.5	90.9	....
Clover (for seed)	76.2	89.7	77.8	....
Potatoes	80.9	73.7	80.4	85.8
Sweet Potatoes	81.3	88.7	85.4	86.9
Apples	44.5	52.1	55.5	46.3
Peaches (production)	43.6	67.5	54.2	....
Pears	53.6	74.1	....	56.4
Grapes	87.2	84.6	83.4	89.7
Watermelons	71.8	80.8	....	75.6
Cantaloupes (production)	73.1	81.0	....	....
Oranges	87.9	88.2	....	86.3
Lemons	87.1	92.9	....	87.0
Tomatoes	81.3	82.5	....	84.2
Cabbages	78.2	80.3	....	85.3
Onions	86.1	85.8	....	88.8
Beans (dry)	85.9	82.8	....	89.1
Beans (lima)	82.0	....	....	85.7
Peanuts	83.3	86.0	....	85.1
Broom corn	76.2	76.6	....	83.5
Hemp	86.5	73.0	....	91.7
Hops	85.7	79.3	85.3	82.7
Sorghum	77.5	85.5	86.0	83.0
Sugar cane	85.4	91.3	89.6	88.6
Sugar beets	88.8	86.0	....	90.4
Cotton	63.7	76.1	....	71.9
Cranberries	82.8	67.7	....	....

Winter wheat, preliminary estimate of production 432,920,000 bushels against 437,908,000 last year; rye, 31,066,000 bushels against 31,851,000 last year; hay, 64,166,000 tons against 70,798,900 tons last year; acreage of clover for seed, 26.9 per cent. less than last year. Number of stock hogs on September 1, 11.1 per cent. less than a year ago.

Traffic Club of New York.

This club has chartered the steamer Frank Jones for the occasion of the marine parade of the Hudson-Fulton celebration October 1. The capacity of this steamer is about 2,200, but on this occasion the number of passengers is limited to 1,200 persons, so as to afford comfort and every convenience to the club and its guests. The club would have no trouble in disposing of all tickets, but has allotted a portion of its tickets for accommodation of outside traffic clubs. The price of tickets is \$3; staterooms from \$1 to \$2.50 each additional. There is a well equipped restaurant on board. The steamer leaves the foot of West Thirteenth street, New York, at 8:30 a.m., and will return about 9 p.m., making the trip from New York to Newburgh. The committee in charge consists of W. R. Campbell, 47 John street; E. G. Warfield, 80 South street, and M. F. Anderson, 320 Broadway.

Bankers on Bill of Lading Forms.

The bill of lading committee of the American Bankers' Association, at the annual convention at Chicago, on September 13, passed a resolution recommending that the uniform bill of lading act approved by the commissioners of uniform state laws at Detroit, Mich., on August 23 last be enacted in every state and territory of the Union. In another resolution Congress was asked to pass a law covering interstate shipments to embody the features contained in the bill relating to bills of lading which was pending before the house committee on interstate and foreign commerce and which was made the subject of four hearings before a sub-committee last winter.

The resolutions, which were to be ratified by the entire

association, were passed at a conference preceding the general sessions of the convention, which was addressed by the following representatives of the shippers, bankers and railways: T. P. Paton, general counsel of the Bankers' Association; Professor Samuel Williston of Harvard Law School; Francis B. James, chairman of the committee on commercial law of the commissioners of uniform state laws; Henry Russell, general counsel Michigan Central and counsel to the carriers' bill of lading committee; Henry Dunkak, president of the New York Mercantile Exchange; J. C. Lincoln, president National Industrial Traffic League, St. Louis; George W. Neville, chairman bill of lading committee, New York Cotton Exchange; Daniel H. Hayne, general solicitor Merchants & Miners' Transportation Company, Baltimore; E. E. Williamson, commissioner Receivers & Shippers' Association, Cincinnati; C. T. Bradford, International Harvester Company of America, Chicago, and J. F. Titus, Illinois Central.

Car Surpluses and Shortages.

Arthur Hale, chairman, has issued American Railway Association Bulletin No. 55, giving a summary of shortages and surpluses of freight cars. He says:

The decrease in surplus shown by this report is 48,848

STATE COMMISSIONS.

Wisconsin: Express Companies Compelled to Make Deliveries.

August H. Strauss v. American Express Co. et al.

Petitioner, a resident of the city of Milwaukee, claims that the defendants refused to deliver express to him and other residents in his vicinity, at their places of business or residences, and claimed such refusal to be an unjust discrimination. It is the duty of express companies to make personal delivery, and arbitrary delivery limits within municipalities cannot be established without subjecting those residing within the boundaries of the municipality, but outside of such limits, to an unjust disadvantage, and the only territorial limits of the service, that may reasonably be adopted, are the natural and established boundaries of the municipality. No injustice will be done defendants by requiring them to extend equal service to all inhabitants residing within a municipality where they maintain messengers, wagons and horses for collecting and delivering goods; and if conditions are such that defendants cannot serve all at the same rates they may lawfully establish zones and graduate their charges accordingly. The regulation of the delivery of interstate shipments is not within the jurisdiction of the commission. An order is made

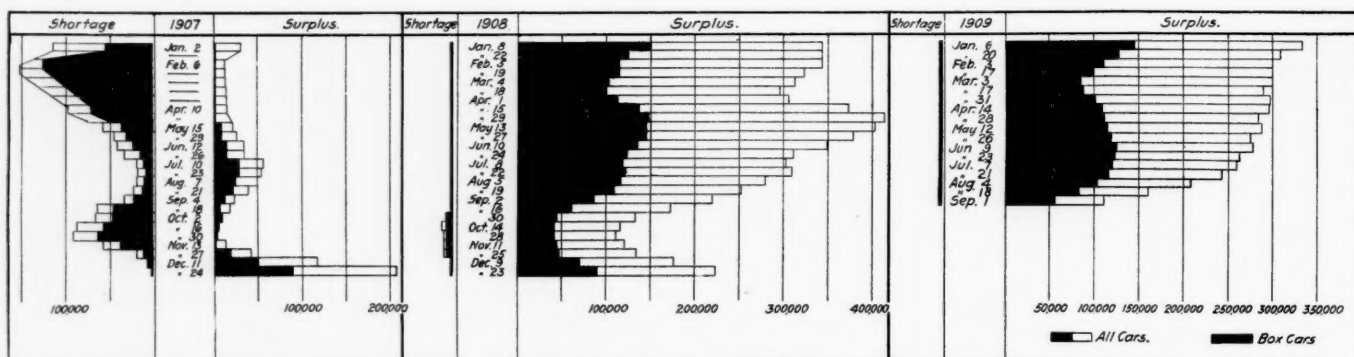
CAR SURPLUSES AND SHORTAGES, APRIL 29, 1908, TO SEPTEMBER 1, 1909, INCLUSIVE.

	Number of roads.	Surpluses.					Shortages.				
		Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
September 1, 1909.....	175	54,284	6,416	25,842	24,034	110,576	1,713	418	1,585	183	3,899
August 18, 1909.....	169	82,505	5,953	42,158	28,808	159,424	556	277	1,076	100	2,009
July 21, 1909.....	165	116,221	9,971	78,675	38,487	243,354	106	169	81	33	339
June 23, 1909.....	166	121,441	12,099	89,292	40,112	262,944	211	190	193	233	827
May 26, 1909.....	158	118,077	14,940	97,006	43,687	273,710	83	99	1,011	47	1,240
April 28, 1909.....	161	107,665	16,487	110,538	47,638	282,328	144	106	74	173	497
March 31, 1909.....	158	101,344	20,428	128,546	46,282	296,600	158	98	116	27	399
February 17, 1909.....	159	98,512	23,924	135,208	43,797	301,441	266	97	11	96	470
January 20, 1909.....	162	127,204	26,723	116,680	41,057	311,664	163	21	139	35	358
December 23, 1908.....	158	87,350	16,247	79,595	38,885	222,077	471	42	289	217	1,019
November 25, 1908.....	160	45,194	12,157	43,854	31,624	132,829	7,923	178	900	209	9,210
October 28, 1908.....	158	39,383	10,185	31,541	29,803	110,912	8,175	167	2,261	236	10,839
September 30, 1908.....	160	42,593	10,365	49,795	31,039	133,792	7,313	450	224	127	8,114
August 19, 1908.....	160	106,367	13,494	92,500	40,642	253,003	465	90	105	194	854
July 22, 1908.....	166	120,580	14,401	125,739	47,960	308,680	115	37	330	27	509
June 24, 1908.....	163	123,112	18,042	130,149	41,995	313,298	266	34	120	31	451
May 27, 1908.....	160	144,697	20,075	162,695	54,437	381,904	82	13	12	18	125
April 29, 1908.....	159	147,971	24,350	186,742	59,542	413,605	145	42	16	64	267

cars, bringing the total down to 110,576, less than one-half the figure for the corresponding period in 1908. The reduction in box is 28,221, and in coal and gondola 16,316 cars. This decrease is comparable both in total cars and by classes with that reported on September 16, 1908, but it will be noted that the reduction this year is fully two weeks ahead of that of last year. There are decreases in every section of the country excepting in group 8 (Middle Western), where box and coal cars increased slightly, and in group 10 (Pacific),

requiring the respondents to deliver intrastate express matter to any person residing within the corporate limits of Milwaukee without exacting a charge in excess of their published schedules.

President Pecanha has asked authority from the Brazilian congress to make the contracts and issue bonds for the electrification of the Central of Brazil Railway in and near Rio de Janeiro. The number of passengers carried has increased



Car Surpluses and Shortages in 1907, 1908 and 1909.

where there was a considerable increase in the stock car surplus. The large accumulation of box cars in group 6 (Northwestern) has been reduced quite sharply, the number dropping from 39,834 to 25,363 since our report of August 26. The scattering shortages continue to increase, totaling 3,899 for this report, about equally divided between box and coal cars.

from 13,423,779 in 1903 to 20,128,387 in 1908, while the means of giving service has not been proportionately increased. It is understood that the preliminary estimates and surveys of the government engineers provide for the third-rail system, and that the work, without materially interfering with traffic, can be finished within two years, at an estimated cost of \$2,500,000.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF JULY, 1909.

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses			Net operating revenues (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) income comp. with last year.
		Freight.	Passenger.	Total.	Way and structures.	Maintenance of equipment.	Traffic.	Trans- portation.				
Atchafalaya, Topeka & Santa Fe.....	7,459	\$4,183,263	\$1,748,933	\$6,403,708	\$1,041,255	\$899,881	\$126,417	\$1,805,341	\$4,012,572	\$239,347	\$2,151,789	\$152,129
Atlanta, Birmingham & Atlantic.....	641	125,271	47,874	182,661	28,114	34,067	11,968	77,086	160,504	8,000	14,158	22,377
Atlantic Coast Line.....	4,476	1,249,917	427,375	1,677,292	309,062	327,646	36,007	665,547	1,395,804	90,000	1,415	55,945
Baltimore & Ohio.....	4,198	5,311,803	1,257,592	6,569,395	1,015,139	1,257,592	154,971	2,129,645	4,705,036	170,555	2,008,840	204,328
Bangor & Aroostook.....	514	144,345	56,641	200,986	36,709	28,149	8,560	60,149	137,151	1,500	80,392	31,597
Boston & Maine.....	2,243	1,972,428	1,475,876	3,448,304	481,797	372,809	40,988	1,422,334	2,401,622	157,561	1,755,821	313,700
Buffalo, Rochester & Pittsburgh.....	568	655,753	97,216	756,584	79,654	153,990	8,617	193,795	449,007	13,000	334,517	146,485
Central of Georgia.....	1,916	534,414	273,000	807,414	157,041	153,986	30,550	268,093	652,939	41,000	185,751	62,135
Central of New Jersey.....	668	1,165,244	467,500	1,632,744	184,925	313,573	26,482	485,447	1,060,650	91,459	655,951	137,350
Chesapeake & Ohio.....	1,903	1,848,290	460,262	2,308,552	301,357	411,331	46,283	629,241	1,434,819	67,500	902,843	124,348
Chicago & Alton.....	998	624,327	369,437	993,764	145,798	124,425	20,371	287,593	698,094	311	359,283	120,115
Chicago & Eastern Illinois.....	965	644,328	157,837	802,165	88,288	124,425	20,371	287,593	553,129	32,400	266,282	68,065
Chicago & North Western.....	7,638	3,706,993	1,692,722	5,399,715	1,057,601	680,732	115,400	2,021,548	3,971,429	228,000	1,700,578	181,833
Chicago, Burlington & Quincy.....	9,021	4,203,663	2,045,978	6,249,641	1,390,992	1,121,655	141,801	1,950,813	4,788,321	215,571	1,812,833	9,954
Chicago, Great Western.....	816	416,410	170,709	587,119	117,179	96,258	37,923	263,978	545,751	17,930	74,659	22,124
Chicago, Indianapolis & Louisville.....	616	310,345	132,688	443,033	68,048	68,033	13,712	147,153	313,342	20,800	153,890	34,090
Chicago, Milwaukee & St. Paul.....	7,511	3,434,494	1,365,963	4,800,457	917,483	607,088	104,522	1,840,368	3,565,116	206,616	1,461,926	162,017
Chicago, Rock Island & Pacific.....	7,414	3,095,810	1,687,973	4,783,783	810,035	622,961	120,500	1,769,730	3,457,155	194,591	1,431,006	163,917
Cleveland, St. Paul, Minn. & Omaha.....	1,739	652,655	394,119	1,046,774	213,142	138,702	23,542	280,929	1,786,217	53,008	286,816	4,528
Cleveland, Cincinnati, Chic. & St. L.....	1,982	1,400,773	695,691	2,096,464	278,282	324,622	78,655	805,235	1,561,631	74,000	659,349	67,764
Colorado & Southern.....	1,250	502,257	179,025	681,282	119,117	132,967	16,545	216,066	505,456	21,625	195,350	50,917
Delaware & Hudson Co.....	845	1,192,931	336,537	1,529,468	138,766	230,208	30,693	514,880	973,314	355	578,148	34,079
Delaware, Lackawanna & Western.....	931	2,281,034	698,236	2,979,270	249,536	200,999	50,052	738,288	1,590,991	98,400	1,493,724	362,720
Denver & Rio Grande.....	2,552	1,349,828	551,123	1,900,951	254,977	217,802	41,577	636,018	1,225,509	61,000	716,646	106,748
El Paso & Southwestern Co.....	877	488,620	92,850	581,470	56,463	56,463	10,263	161,708	373,671	17,167	234,669	34,861
Elgin, Joliet & Eastern.....	768	716,273	31,222	747,495	52,401	116,513	4,263	188,664	373,913	13,500	275,008	164,581
Florida East Coast.....	1,955	2,485,193	871,540	3,356,733	455,904	708,920	89,256	1,140,513	2,475,401	86,418	1,085,283	128,328
Fort Worth & Denver City.....	583	84,503	162,715	247,218	32,296	32,296	4,095	170,632	163,493	11,544	3,221	42,924
Galveston, Harrisburg & San Antonio.....	1,338	496,888	202,887	699,775	139,363	123,569	22,767	280,929	242,478	9,300	166,107	20,553
Grand Rapids & Indiana.....	6,971	3,116,892	1,639,596	4,756,488	533,312	525,005	71,306	1,671,478	3,084,669	28,793	146,655	10,457
Great Northern.....	6,971	3,116,892	1,639,596	4,756,488	533,312	525,005	71,306	1,671,478	3,084,669	28,793	146,655	10,457
Houston & Santa Fe.....	1,518	324,304	263,482	587,786	183,869	142,343	21,731	333,017	371,156	22,520	2,060,791	773,950
Houston & Texas Central.....	4,550	2,761,002	1,001,128	3,762,130	892,510	1,110,367	95,612	1,471,775	3,222,622	19,632	102,541	84,153
Iowa Central.....	558	188,784	31,222	219,996	35,281	45,660	9,297	115,290	373,671	7,402	31,162	23,870
Kansas City Southern.....	827	467,107	121,752	588,859	85,062	100,145	25,720	233,610	474,260	23,623	161,431	98,248
Lake Erie & Western.....	1,886	2,489,508	1,023,690	3,513,198	704,474	578,053	12,594	1,500,697	3,282,061	18,271	1,439,894	310,064
Lake Shore & Michigan Southern.....	1,511	2,489,508	1,023,690	3,513,198	704,474	578,053	12,594	1,500,697	3,282,061	18,271	1,439,894	310,064
Louisville & Nashville.....	4,398	2,742,290	904,712	3,647,002	436,356	626,346	89,355	1,164,186	2,481,816	124,610	1,331,185	150,371
Maine Central.....	1,746	1,369,683	689,135	2,058,818	336,478	331,075	10,349	1,212,127	1,551,293	31,962	287,712	88,394
Manitowish & St. Louis.....	1,027	1,225,826	116,263	1,342,089	41,324	40,765	16,062	121,726	2,226,944	13,816	619,962	71,080
Missouri & Kansas.....	3,072	1,189,341	592,989	1,782,330	298,090	224,324	52,660	703,875	1,379,931	353,931	121,879	30,580
New York Central & Hudson River.....	3,587	4,654,802	1,543,305	6,198,107	1,185,441	767,071	47,816	2,833,658	5,423,427	363,435	2,065,333	497,436
New York, New Haven & Hartford.....	2,044	2,371,506	2,269,960	4,641,466	573,979	569,170	29,560	1,829,350	3,809,356	260,031	2,000,031	83,115
New York, Ontario & Western.....	546	555,681	263,303	818,984	138,255	110,035	11,754	273,158	550,899	285,000	1,857,049	546,792
Norfolk & Southern.....	582	123,038	70,932	193,970	27,994	23,835	5,789	65,552	137,132	15,000	293,142	26,044
Norfolk Pacific.....	1,941	2,151,561	346,180	2,497,741	283,182	469,415	43,355	718,667	1,371,556	84,000	923,543	49,410
Oregon R. R. & Navigation Co.....	5,692	3,708,318	2,627,065	6,335,383	993,843	848,203	88,239	1,698,458	3,722,890	254,523	2,795,161	414,236
Oregon Short Line.....	1,327	714,915	440,806	1,155,721	126,604	76,323	31,997	301,481	568,103	42,190	620,176	65,790
Pennsylvania Co. (west of Pittsburgh).....	1,508	1,122,993	539,311	1,662,304	230,934	126,120	20,831	304,732	712,312	5,140	50,000	118,029
Pere Marquette.....	1,416	3,402,237	683,516	4,085,753	177,769	176,331	36,953	465,083	2,598,768	180,748	1,655,630	289,165
Philadelphia & Reading.....	2,360	713,807	403,414	1,117,221	177,769	176,331	36,953	465,083	884,609	47,464	284,079	87,374
Pittsburgh, Cin., Chic. & St. L.....	1,468	1,910,820	500,580	2,411,400	383,456	494,487	63,105	947,368	1,962,690	1,090,070	1,015,647	21,375
Rutland.....	4,726	1,354,591	117,395	1,471,986	490,810	437,608	73,026	1,008,813	1,87,027	9,858	83,622	25,651
St. Louis & San Francisco.....	4,726	2,010,704	876,312	2,887,016	311,178	280,507	6,425	91,895	2,102,105	103,450	913,241	211,758
St. Louis Southwestern.....	773	388,640	112,797	501,437	47,071	36,507	73,026	1,008,813	1,87,027	9,858	83,622	25,651
St. Louis Southwestern of Texas.....	697	174,566	81,971	256,537	56,153	82,894	19,660	121,215	299,325	224,134	913,241	211,758
San Antonio & Aransas Pass.....	727	162,256	93,776	256,032	64,225	70,162	8,275	108,806	265,911	8,333	766	28,155
San Pedro, Los Angeles & Salt Lake.....	1,105	379,248	321,850	701,098	92,506	98,911	26,013	217,129	210,017	9,000	53,879	5,567
Seaboard Air Line.....	2,603	826,628	304,245	1,130,873	201,465	173,130	55,049	412,863	901,955	24,388	274,037	169,946
Southern.....	7,050	2,747,925	1,275,363	4,023,288	506,006	773,352	108,072	1,461,863	2,561,625	153,000	313,257	55,143
Southern Pacific—Pac. Syst.....	6,045	4,385,596	2,940,420	7,326,016	814,562	1,022,652	106,529	1,892,662	5,433,354	240,062	3,600,839	460,852
Texas & New Orleans.....	457	189,602	81,892	271,494	47,708	50,273	6,310	102,166	217,327	11,600	62,699	3,624
Texas & Pacific.....	1,884	638,657	318,650	957,307	301,514	195,012	17,806	428,380	880,644	38,200	98,525	7,478
Toledo, St. Louis & Western.....	451	244,374	39,738	284,112	37,258	45,126	6,862	95,375	192,880	12,000	99,322	5,819
Union Pacific.....	3,310	2,962,244	1,060,341	4,022,585	483,902	380,032	181,452	967,707	2,948,737	120,175	2,218,933	296,372
Vandalia.....	827	452,290	188,449	640,739	123,704	131,352	20,993	264,810	568,627	23,243	130,045	22,786
Wabash.....	2,515	1,430,283	646,642	2,076,925	310,807	297,639	80,620	921,596	1,575,513	64,791	597,136	32,176
Wheeling & Lake Erie.....	8	491,943	56,109	548,052	75,472	120,179	8,027	172,176	391,452	22,906	182,364	8,695
Yazoo & Mississippi Valley.....	1,370	417,210	157,889	575,099	210,906	156,068	14,959	240,856	647,940	34,740	59,613	54,208

*Includes Cleveland, Lorain & Wheeling Rv., heretofore reported independently. †Includes Bangor & Portland Rv., heretofore reported independently. ‡Includes Chicago, Lake Shore & Eastern R.R., heretofore reported independently. §Expenditures made under Receiver's Certificates not included. —Indicates deficits, losses and decreases.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

J. W. Lester has been appointed auditor of the Tampa Northern, with office at Tampa, Fla., succeeding A. G. Brewer.

The office of Edward Hughes, auditor of the Lehigh & New England, has been transferred from Bethlehem, Pa., to Philadelphia.

John B. Parsons, president of the Philadelphia Rapid Transit Co., has retired as president to take the new office of chairman of the board.

W. W. Baldwin, assistant to the president of the Chicago, Burlington & Quincy, has been elected fourth vice-president, with office at Chicago.

Frank S. Yantis, superintendent of the Dardanelle, Ola & Southern, is also auditor and treasurer, in charge of all departments, with office at Dardanelle, Ark.

The general offices of the Licking River Railroad have been transferred from Chicago to 1608 First National Bank building, Cincinnati, Ohio.

Lucien J. Irwin, general superintendent of the Louisville, Henderson & St. Louis, has been elected president, succeeding Attila Cox, deceased.

F. C. Anderson has been appointed assistant auditor of the Missouri, Kansas & Texas, with office at St. Louis, Mo., succeeding Walter V. Bolman, resigned to go into other business.

H. E. Bateman has been appointed auditor of the Western Allegheny, with office at Pittsburgh, Pa., succeeding J. E. Collin, previously acting auditor, who remains assistant treasurer.

A. B. Newell, superintendent of the Mexican division of the National Railways of Mexico, with office at Mexico City, has been elected president of the Tennessee Central, succeeding George W. Ristine, recently resigned.

J. P. Jones, foreign freight agent of the Gulf, Colorado & Santa Fe at Galveston, Tex., has been elected second vice-president and general manager of the Gulf & Interstate, with office at Galveston, succeeding J. R. Dillon, resigned. W. Moody, Jr., has been elected a director, succeeding B. F. Bonner, resigned.

The officers of the San Diego & Cuyamaca are as follows: W. Clayton, president; C. L. Bundy, former vice-president of the San Diego, Cuyamaca & Eastern, vice-president and treasurer; H. L. Titus, counsel, and J. F. Lamond, former auditor of the San Diego, Cuyamaca & Eastern, secretary and auditor, all with offices at San Diego, Cal. This company had bought all the property of the San Diego, Cuyamaca & Eastern.

Robert S. Lovett, vice-president and general counsel of the Union Pacific, vice-president and counsel of the Oregon Short Line, counsel for the Oregon Railroad & Navigation Co., and president of the Houston & Texas Central, the Houston, East & West Texas and the Houston & Shreveport, has been elected chairman of the executive committee of the Union Pacific, succeeding Edward H. Harriman, deceased. Details of Mr. Lovett's career are published elsewhere in this issue. Jacob H. Schiff, of Kuhn, Loeb & Co., bankers, and William Rockefeller, of the Standard Oil Co., were elected members of the executive committee, succeeding Mr. Harriman and Henry H. Rogers, deceased.

W. B. Storey, Jr., chief engineer of the Atchison, Topeka & Santa Fe at Chicago, has been elected vice-president, in charge of construction, and W. E. Hodges, general purchasing agent at Chicago, has been elected vice-president, in charge of purchasing and stores, both with offices at Chicago. These promotions are effective October 1. The present system of designating the vice-presidents as second, third and fourth will be discontinued, and they will hereafter be distinguished by the departments over which they have jurisdiction. Mr. Storey

was born November 17, 1857, at San Francisco, Cal., and graduated from the University of California in 1881. He began railway work in 1877 as axman on the Southern Pacific, giving this up at the end of a year to enter college. From 1881 to 1893 he was consecutively rodman, levelman, transitman and assistant engineer on the Southern Pacific. In 1893 he was made assistant engineer of the United States Hydraulic Mining Commission, and from 1895 to 1900 was chief engineer and general superintendent of the San Francisco & San Joaquin valley. In 1900 he was appointed chief engineer of the Atchison, Topeka & Santa Fe at Topeka, becoming chief engineer of the entire system, with office at Chicago, in September, 1906, which position he has held until the present time. Mr. Hodges was born July 23, 1860, at Fall River, Mass. After receiving a high school education he began railway work in November, 1881, as clerk in the general superintendent's office of the Chicago, Burlington & Quincy. From 1883 to 1889 he was consecutively chief clerk to the trainmaster, clerk with the general freight agent and assistant to the general manager. In the latter year he was made traffic manager of the Fraser & Chalmers Co., Chicago. In January, 1896, he was appointed private secretary to the president of the Atchison, Topeka & Santa Fe, and in April, 1897, was made general purchasing agent, from which position he is now promoted to vice-president.

Operating Officers.

The Hine system of organization having been established on the Harriman Lines in Washington and Oregon, the following officers will hereafter be designated as assistant superintendents and their present titles are abolished: T. W. Younger, master mechanic; C. C. Blood, division engineer; C. H. Fox and E. B. Pengra, Southern Pacific Lines in Oregon. C. W. Martyn also continues with the title of assistant superintendent.

J. T. Langley, master mechanic; A. F. Stotler, division engineer; A. Buckley, chief dispatcher; J. F. Corbett, chief dispatcher; W. E. Borden and J. C. Shea, Oregon division, Oregon Railroad & Navigation Company. J. D. Matheson also continues with the title of assistant superintendent.

R. O. Cowling, trainmaster; J. H. Robb, division engineer; T. F. Quinn, division master mechanic; H. L. Buchanan, chief dispatcher; J. Beck, chief dispatcher, Washington division, Oregon Railroad & Navigation Company. W. M. Gleason also continues with the title of assistant superintendent.

S. E. Canady, trainmaster; H. J. Harris, division engineer; George Ross, master mechanic; O. B. Chalmers, trainmaster; F. A. Leute, chief dispatcher, Oregon Short Line.

L. L. Ward, general superintendent of the Wells, Fargo & Company Express in Mexico, has been elected president of the Compania Mexicana de Express of Mexico, which takes over the Business of Wells, Fargo & Co.

D. W. Campbell, superintendent of the Southern Pacific Lines in Oregon at Portland, Ore., has been appointed an assistant general manager of the Oregon Railroad & Navigation Company, with office at Seattle, Wash.

E. A. Gould, general superintendent of the Missouri Pacific and St. Louis, Iron Mountain & Southern, has been appointed general superintendent of the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio, succeeding J. A. Gordon, resigned.

E. A. Hornbeck, general manager of the San Diego, Cuyamaca & Eastern, has been appointed general manager of the San Diego & Cuyamaca, with office at San Diego, Cal. This company has bought all the property of the San Diego, Cuyamaca & Eastern.

W. J. McKee, general superintendent of the Missouri Pacific and the St. Louis, Iron Mountain & Southern at Little Rock, Ark., has been transferred to Kansas City, Mo., succeeding E. A. Gould, resigned to accept service with another company. M. M. Richey, superintendent of the Arkansas division at Little Rock, succeeds Mr. McKee. J. F. Murphy, superintendent of the Central division at Van Buren, Ark., succeeds Mr. Richey, and C. B. Wildman, trainmaster at Van Buren, succeeds Mr. Murphy.

F. P. Pelter, superintendent of the Asheville division of the Southern Railway at Asheville, N. C., has been transferred to the Memphis division, with office at Memphis, Tenn., succeeding J. A. Heather, deceased. C. C. Hodges, trainmaster in charge of the line between Chattanooga, Tenn., and Knoxville, at Knoxville, succeeds Mr. Pelter. O. B. Keister, trainmaster in charge of the lines between Morristown, Tenn., and Asheville, N. C.; Knoxville, Tenn., and Bristol, and the Embreeville and Rogersville branches, succeeds Mr. Hodges, and W. C. Hudson succeeds Mr. Keister.

Traffic Officers.

W. J. Nolan has been appointed a commercial agent of the Gulf & Interstate, with office at Galveston, Tex.

J. J. Quill has been appointed a soliciting freight agent of the Alabama Great Southern, with office at Mobile, Ala.

Louis J. Reinhardt, traveling freight and passenger agent of the Fort Worth & Denver City at New Orleans, La., has resigned.

The office of W. E. Pinckney, general freight agent of the Chicago Great Western, has been transferred from St. Paul, Minn., to the Harvester building, Chicago.

J. H. Meglemry has been appointed a traveling freight agent of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Columbus, Ohio. He will report to W. G. Pennell, division freight agent.

Frank J. Martin has been appointed an assistant general freight agent of the New York, Chicago & St. Louis, with office at Chicago, succeeding B. E. Morgan, appointed manager of the Traders' Despatch.

B. E. Morgan, assistant general freight agent of the New York, Chicago & St. Louis at Chicago, has been appointed manager of the Traders' Despatch, with office at Chicago, succeeding Lafayette Briggs, deceased.

B. H. Stephens, commercial agent of the Trinity & Brazos Valley at Corsicana, Tex., has been appointed general industrial and immigration agent, with office at Corsicana. He will have charge of the territory from Houston to Dallas.

The general freight department of the Chicago Great Western was transferred on September 7 from St. Paul, Minn., to Chicago, in charge of Joseph W. Blabon, vice-president in charge of traffic, and W. E. Pinckney, general freight agent.

J. W. Allison, assistant general freight agent of the Cincinnati, Hamilton & Dayton at Cincinnati, Ohio, has been appointed general freight agent, with office at Cincinnati, and the position of assistant general freight agent has been abolished.

V. K. Nordert has been appointed a commercial freight agent of the Missouri Pacific and the St. Louis, Iron Mountain & Southern, with office at Cleveland, Ohio, and G. L. Putsche has been appointed a commercial freight agent, with office at Texarkana, Ark.

Herman S. Terry, traveling freight agent of the Kansas City Southern at Dallas, Tex., has resigned to engage in the exchange brokerage business. B. W. Haughton, chief cotton clerk of the Missouri, Kansas & Texas, succeeds Mr. Terry, with office at Dallas.

E. J. Naylor, southwestern passenger agent of the Toledo, St. Louis & Western and the Chicago & Alton at Dallas, Tex., has been appointed general agent, passenger department, with office at San Francisco, Cal. A. D. Perry, division passenger agent at Mexico, Mo., has been appointed a general agent, with office at Denver, Colo.

Elmer A. Thayer has been appointed a traveling passenger agent of the Chicago, St. Paul, Minneapolis & Omaha, with office at St. Paul, Minn., succeeding Clinton R. Chapman, deceased. He is in charge of passenger traffic on all divisions of the road and will perform such other duties as may be assigned to him by the general passenger agent.

W. J. Nolan, commercial agent of the Gulf, Colorado & Santa Fe at Galveston, Tex., will succeed to the duties of the foreign

freight agent, with office at Galveston, succeeding J. P. Jones, resigned, but will retain his present title. W. L. McWhirter, soliciting freight agent at Fort Worth, Tex., assumes also the duties of commercial agent at Galveston, succeeding Mr. Nolan.

W. F. Schmidt, assistant general freight agent of the Wabash at St. Louis, Mo., has been appointed general western agent of the Missouri Pacific-Iron Mountain system, with office at San Francisco, Cal., succeeding to the duties of W. J. Shotwell, general agent. W. Q. Hodgson, contracting freight agent at Dallas, Tex., has been appointed a traveling freight agent, with office at Fort Worth, Tex., and will have charge of the territory west of Fort Worth. T. V. Murray, Jr., succeeds Mr. Hodgson.

Engineering and Rolling Stock Officers.

W. R. Hollick has been appointed a roadmaster of the Atchison, Topeka & Santa Fe, with office at Canadian, Tex.

John A. Knox has been appointed engineer of the Louisiana & North-West, with office at Homer, La., succeeding W. A. Hunicke.

E. F. Holland has been appointed a roadmaster of the Marshall & East Texas, with office at Marshall, Tex., succeeding S. R. Stewart.

C. C. Berkeley, division engineer of the Oregon Railroad & Navigation Company at Portland, Ore., has been appointed assistant engineer of the Oregon & Washington, with office at Seattle, Wash.

W. L. Allison, mechanical engineer of the Atchison, Topeka & Santa Fe at Chicago, has resigned to become mechanical manager of the Franklin Railway Supply Co., New York, with office at New York.

George H. Burgess, chief engineer of the Delaware & Hudson, is also a consulting engineer of the Quebec, Montreal & Southern, a subsidiary of the Delaware & Hudson, with office at Albany, N. Y., and not chief engineer, as reported in these columns last week.

Special Officers.

H. H. Fair, land and industrial agent of the Western Allegheny, with office at Pittsburg, Pa., has resigned to go to another company.

OBITUARY.

J. F. Murphy, general foreman of the Houston & Texas Central at Ennis, Tex., died at Ennis, September 12, of heart trouble.

John N. A. Griswold, a former president of the Illinois Central, died on September 13 at his home in Newport, R. I., at the age of 88 years.

Henry W. Brinkerhoff, a civil engineer and a member of the American Society of Civil Engineers, died at his home in Brooklyn, N. Y., September 7. Mr. Brinkerhoff was born in May, 1845. He served in the civil engineer corps of the United States Navy, and was later connected with the construction of the Jersey City water works, the West Shore Railroad, the Sixth avenue elevated railroad, New York City; the Brooklyn bridge and the New York Steam Co. For a while he was the technical editor of the *Engineering Record*, resigning to become office engineer of the organization in charge of the installation of the cable railway on Broadway in New York City. After the completion of that work he was a general consulting engineer for a number of years, and was lately connected with the staff of William Barclay Parsons.

Careful explorations have been made in North Germany for terminal moraines in order to extract from them the hard boulders and break them up for ballast and road metal. The moraines are very extensive, but not always easy to find; and the places where the boulders are plentiful enough to warrant sidings and machinery for ballast are greatly valued in that sandy country.

Railroad Construction.

New Incorporations, Surveys, Etc.

ALABAMA ROADS.—An officer of the Shinbone Valley Iron & Timber Co. writes that surveys for a new line have been made from Abel, in Cleburne county, south to Pyriton, in Clay county, 16 miles, where connection is to be made with the Atlanta, Birmingham & Atlantic. R. F. Kolb, president, Anniston, Ala.

ALBANY & HUDSON (ELECTRIC).—See Albany Southern.

ALBANY SOUTHERN (ELECTRIC).—Incorporated in New York, with \$3,475,000 capital and office at Rensselaer, N. Y., to take over the property of the Albany & Hudson, the sale of which is mentioned under Railroad Financial News. It is expected that the grading for second main track will be started and finished this fall. Improvements are to be made to the power plant at Stuyvesant Falls and plans are under consideration for a line running northeast to Pittsfield, Mass. The directors include W. R. Gross, C. H. Werner, A. C. Smith, A. M. Young, I. W. Day, L. B. Grant and G. M. Congdon, of New York; C. L. Rossiter, of Brooklyn, and Myron T. Herrick, of Cleveland, Ohio.

ARIZONA & CALIFORNIA.—See Atchison, Topeka & Santa Fe.

ATCHISON, TOPEKA & SANTA FE.—An officer writes that plans are being made to relay the present track from Newton, Kan., south to Arkansas City, 78 miles, and from Arkansas City south to Purcell, Okla., 153 miles, with 90-lb. rail. It is also the intention to lay 90-lb. rail from Ottawa, Kan., south to Cherryvale, 101 miles, as well as from Augusta south to Winfield, 31 miles, and Mulvane southwest to Wellington, 19 miles. Most of the line on which improvements are to be made is now laid with 65 and 75-lb. rails, and when all these improvements are made the main track from Chicago via Newton through to Purcell and also via Florence and Augusta to Wellington will all be laid with 85 and 95-lb. rails. There will also be 75 and 90-lb. rails on the main track on the Southern Kansas division from Ottawa via Chanute and Independence to Wellington. The rails will be delivered and laid this winter and during the early spring of 1910. (Aug. 27, p. 383.)

According to press reports a contract was recently let to Scott, Smith & Co., of St. Louis, for building the remaining 90 miles on the Arizona & California from the Colorado river west to Bengal, Cal., the work to be finished by May, 1910. (Sept. 3, p. 426.)

ATLANTIC COAST LINE.—Bids are wanted up to September 23 for grading, concrete and track laying work in connection with the grade and line revision of the Wadesboro branch between Florence, S. C., and Wadesboro, N. C. The work will involve the excavation of 1,100,000 cu. yds., the construction of 14,000 cu. yds. of concrete and laying 15 miles of track.

BARTLETT & FLORENCE.—Contract is said to have been given to the J. Bowers Construction Co. to build from Bartlett, Tex., west to Florence, 23 miles. The work is to be started at once. G. W. Hubbard, president, and W. J. McDaniel, vice-president and general manager, Bartlett.

CAIRO & THEBES.—An officer writes that the only work now under way by this company is the completion of the earthwork for yards at Cairo, Ill. The Cairo Sand & Gravel Co., of Cairo, have the contract. J. E. Willoughby, chief engineer, Cairo. (March 19, p. 652.)

CANADIAN NORTHERN ONTARIO.—The line extending from Hawkesbury, Ont., west to Rockland, 35.70 miles, was opened for business on August 22.

CANADIAN PACIFIC.—An officer of the Esquimalt & Nanaimo writes that an extension is being built westward 58 miles to Alberni, on the west coast of Vancouver island. Contracts have been let for 30 miles and work on this section is nearly finished. Additional contracts for the remaining 28 miles are to be let in September. The work will be heavy, much of it being on the mountain side. Maximum grades will be 1.5 per cent. and maximum curvature 12 deg. There will be eight steel bridges ranging from 50 to 125 ft. each. (March 19, p. 660.)

CANCHO, SAN SABA & LLANO VALLEY.—An officer writes that work is now under way from Miles, Tex., southeast to Paint Rock, and track has been laid on about five miles. Plans are under way to build an extension of the line. R. A. Love is vice-president and general manager, Miles. (April 16, p. 871.)

CHICAGO & NORTH WESTERN.—According to press reports a contract has been given to Winston Brothers for a 29-mile extension from Belle Fourche, S. Dak., north. Aug. 27, p. 383.)

Surveys are said to have been made from Lander, Wyo., west, thence north for a line to parallel the Butte-Salt Lake branch of the Oregon Short Line through the eastern section of Idaho and the border of Yellowstone Park, where a pass is located to Armstead, Mont.

CHICAGO, AURORA & DE KALB.—This company is offering bonds amounting to \$200,000. The proceeds are to be used for electrically equipping 31 miles of line, connecting Aurora, Ill., with De Kalb. The line is now in operation and using steam as the motive power. The work is to be finished in about two months.

DETROIT, LANSING & GRAND RAPIDS.—Bids were asked for up to September 15 for surveys and plans for an electric line from Farmington, Mich., west to Lansing, about 62 miles. F. A. Bean, chief engineer, 706 Union Trust building, Detroit, Mich. (Aug. 6, p. 258.)

ESQUIMALT & NANAIMO.—See Canadian Pacific.

FORT SMITH, SUBIACO & EASTERN.—An officer writes that work is now under way on an extension east from the present terminus at Subiaco, Ark., seven miles. When this improvement is finished the line will have a total length of 13 miles. Plans have been made to build 11 miles of branches to develop the anthracite coal field near Scranton, also to open large tracts of hardwood timber lands. All the contracts have been let. (July 23, p. 168.)

FRANKLIN & ABBEVILLE.—An officer writes that contracts have been let to O'Reilly & Sullivan and work is to be started about October 1 on an extension from David Junction, in Iberia Parish, La., northwest via Youngville to Milton, on the Vermillion river in Lafayette parish, about 20 miles. The work will include four bridges, ranging in length from 26 to 35 ft. each. (Aug. 13, p. 296.)

GRAND TRUNK PACIFIC.—An officer is quoted as saying that it is the intention to build at an early date a direct line from Vancouver, B. C., north via Prince Rupert to Dawson City, Yukon.

Track laying is said to have been started on the branch from Melville, Sask., south to Regina, and track laying is to be started shortly from Melville north to Yorkton. It is expected to have these two branches finished this fall.

J. D. McArthur & Co., of Winnipeg, Man., who have the contract for building 50 miles of the branch from Tofield, Alb., south to Calgary, has given a sub-contract to George H. Webster and work will be started at once. (Aug. 13, p. 297.)

GULF, COLORADO & SANTA FE.—An officer writes confirming the report that a line is to be built from a point on the Lampasas branch between Lampasas, Tex., and Brownwood west via San Saba and Richland Springs to the western boundary of San Saba county, about 45 miles. Surveys are now being made and contracts for the work will probably be let as soon as the surveys are finished. (Sept. 10, p. 478.)

HUMBOLDT & EASTERN.—A promoter writes that preliminary surveys are being made for a line from Eureka, Cal., east to Upper Sacramento Valley, at or near Redding or Red Bluff, about 125 miles. W. S. Clark is chairman; E. E. Skinner, secretary, and J. N. Lentell, engineer. (See Redding-Eureka Electric, Sept. 10, p. 479.)

IDAHO ROADS.—Contract is said to have been given to Naylor & Norlin, contractors, of Spokane, Wash., to build a five and a half miles logging line for the Craig Mountain Lumber Co. from the Northern Pacific about three miles south of Rubens, Idaho. The estimated cost of the grading is \$50,000.

KANSAS CITY SOUTHERN.—An officer writes that contracts have been let to the Ferguson Construction Co., 37 Wall street, New York, and to the Arnold Co., 181 La Salle street, Chicago,

for revision work on this line, reducing the grades to a maximum of .5 per cent., and the construction of division terminals at Heavener, Okla., DeQueen, Ark., Shreveport, La., and Leesville. (May 21, p. 1099.)

KANSAS-COLORADO.—An officer writes that the projected route is from Pueblo, Colo., northwest to Canon City, 40 miles. Rights-of-way have been secured through the city of Pueblo and 20 miles is graded and ready for bridge work. Some contracts will be let this fall. J. D. Bowersock, president, Lawrence, Kan.

KENTUCKY MIDLAND.—Contract is said to have been given to J. R. McDowell & Co., contractors, of Knoxville, Tenn., for an extension of nine miles.

LAURINBURG & SOUTHERN.—Preliminary surveys are said to be finished and contract has been let to Wode & Morrison, of Laurinburg, N. C., to build from John Station, N. C., east to Wagram, 12 miles. J. F. McNoir, president, and G. B. Husk, chief engineer, Laurinburg.

LOUISVILLE, HENDERSON & ST. LOUIS.—The new line from Mitchell, Ky., on the Fordsville branch, southwest to Hartford, 18.4 miles, has been opened for business.

MERCER ELECTRIC.—Contract is said to have been given to Peck & Brown, of Princeton, W. Va., to build from Athens, W. Va., southwest to Princeton, six miles. There will be three trestles on the line. R. G. Meador, president.

NATCHEZ, COLUMBIA & MOBILE.—Contract is said to have been given to the Worthington Construction Co., of Brookhaven, Miss., to build an extension of five miles. The company operates a 30-mile road in Mississippi and is making improvements, including a revision of line, to secure lighter grades (March 19, p. 656.)

NEVADA, CALIFORNIA-OREGON.—An officer writes regarding the reports that extensive improvements are to be made to the existing line and an extension built from Alturas, Cal., north for about 58 miles, that contracts for the work are to be let soon. (Aug. 27, p. 383.)

NEWPORT NEWS & YORKTOWN.—Incorporated in Virginia, with \$25,000 capital, to build from Newport News, Va., north to Yorktown, 20 miles. W. T. Chapin, president, Newport News, and C. P. Jones, secretary and treasurer. The directors include: W. D. Copeland, F. R. Carty and C. T. Hobart, all of Newport News.

NORTHWESTERN PACIFIC.—According to press reports plans are being made to build an extension from Willets, Cal., north to a connection with the Eureka line.

PACIFIC RAILWAY & NAVIGATION Co.—An officer writes that contracts have been let to the J. W. Sweeny Contracting Co., S. M. Bumaner and Isaac Bumaner, for building 91 miles of line west from Hillsboro, Ore. Track has been laid for 40 miles. The maximum curvature will be 10 deg. and maximum grade will be 2 per cent. The company has already finished work on 17 tunnels, the longest of which is 1,400 ft. (Aug. 20, p. 339.)

PENNSYLVANIA.—An officer writes that the general contracts for the Greensburg, Pa., improvements has been let to the Milard Construction Co., of Philadelphia, Pa.

QUANAH & GULF.—Contracts are to be let about January 1 and work started soon after that time on a line from Quanah, Tex., south via Medicine Mound to Crowell, thence southeast via Seymour and Graham to Waco, thence to a point on the Gulf. The road will run through level country except on the section from Medicine Mound to Crowell. There will be about 10 steel bridges on the line. Address L. E. Walker, Quanah.

QUANAH, ACME & PACIFIC.—An officer writes that this line was opened for business from Quanah, Tex., to Lazare, 14.74 miles, on August 17. Grading work southwest to Paducah is finished and all material for track laying is on the ground. The work is being held up until several canyon bridges are in place near the Pease river which are expected to be finished soon, when track laying will be resumed and the work pushed to complete the line to Paducah. The canyon bridge is a triple-deck structure 373 ft. long and 77 ft. high. At Pease river, two miles beyond the canyon bridge, there

is a pile trestle 1,900 ft. long. The line is to be extended eventually beyond Paducah in the direction of Roswell, N. Mex., in all about 350 miles. (Aug. 20, p. 339.)

ROANOKE & BENT MOUNTAIN.—Surveys are said to have been made, but it is undecided when the construction work is to be started on this line. The projected route is from Roanoke, Va., southwest via Air Point, and Bent Mountain to Floyd, 45 miles. W. C. Lawson, president, Roanoke. (Nov. 13, p. 1374.)

ST. LOUIS & SAN FRANCISCO.—An officer writes that contract has been given to Henry Dalhoff, of Little Rock, Ark., for the grading and bridge work on the cut-off being built from Hulbert, Ark., north to Marion, about five and a half miles. The track laying is to be done by the company's men. The work includes putting up about one-quarter of a mile of creosoted pile bridges. (Sept. 3, p. 427.)

SOUTHERN PACIFIC OF MEXICO.—An officer writes that the Cananea, Yaqui River & Pacific is building from Corral, Sonora, up the Yaqui river, via Soyopa, Suaqui de Battuc, Moctezuma and Cuppas to Nacozari. The Grant Brothers Construction Co. has the general contract. This line has been finished from Corral north for 69 miles to a point about 10 miles north of Tufanito. The company has a concession for a line from the junction of the Baviste river with the Moctezuma and Yaqui rivers north to the United States boundary, but no surveys or plans for building the line have been made. (June 25, p. 1546.)

TAMPA NORTHERN.—Bids are asked September 20 to build an extension from Brooksville, Fla., north to Dunnellon, about 37 miles. (March 19, p. 658.)

TENNESSEE CENTRAL.—An officer writes that a preliminary survey is now being made for an extension from Hopkinsville, Ky., northwest via Gracey, Cadiz and Rockcastle, on the Cumberland river, and Birmingham, on the Tennessee river, to Paducah, 70 miles. Bridges will be built over the Cumberland and Tennessee rivers.

TIPPECANOE & MONTICELLO INTERURBAN.—Incorporated in Indiana, with \$100,000 capital and office at Monticello, Ind., to build lines connecting Fowler, Lafayette, Battle Ground, Ash Grove, Delphi, Brookston, Chalmis, Wheeler, Reynolds, Monticello, Sitka, Buffalo, Headlee, Pulaski, Winamac, Idaville, Burnettsville, Curveton, Trimmer and Logansport. The incorporators include: W. B. Felker, C. E. Turner, T. W. O'Connor, J. A. C. Blackburn and W. R. White.

UNION PACIFIC.—According to press reports plans are being made to build a 48-mile cut-off from Bennett, Colo., which is 31 miles east of Denver, on the Kansas City division, northeast to Fort Morgan. The new route will be 79 miles from Denver to Fort Morgan, as compared with 98 miles over the present line from Denver north via La Salle, thence east to Fort Morgan.

VANCOUVER TRACTION.—An officer writes that a contract has been given to the Clark County Development Co., of Vancouver, Wash., and work is now under way on about six miles from Vancouver east. The work includes putting up an 800-ft. pile bridge of three spans over Dry creek, two miles east of Vancouver. (Aug. 20, p. 339.)

WESTERN MARYLAND.—This company has listed bonds, the proceeds of which are to be used for improvements. The work includes the construction of the Cumberland extension between Big Pool, opposite Cherry Run, at a point near Cumberland, Md., also terminals and terminal facilities near Baltimore; new shops, stations, terminals, yards and general betterments of the road.

WICHITA FALLS ROUTE.—An officer of the Wichita Falls & Northwestern is quoted as saying that an extension is to be built at once from a point near Mangum north to either Elk City or Sayre, in Beckham county, about 40 miles. (July 2, p. 35.)

WINDSOR TUNNEL & LAKE ERIE.—Plans are said to be made to start work soon on a line to connect Windsor, Ont., with Sandwich, West Vereker, New Canaan, McGregor, Huron and Oakley, about 30 miles. R. A. Bailey, president, Detroit; Dr. J. A. Smith, vice-president, and Walter Boug, treasurer, both of Windsor.

Railroad Financial News.

ALBANY & HUDSON.—The property and franchises of this company were sold under foreclosure at Hudson, N. Y., September 8, the buyer being I. W. Day, acting for the reorganization committee. It is expected that reorganization will at once be completed, and that the grading for a second main track will be begun and finished this fall. Improvements will be made to the power plant at Stuyvesant Falls and a line northeastward to Pittsfield, Mass., is under consideration.

BUFFALO, ROCHESTER & PITTSBURGH.—See Lake Shore & Michigan Southern.

CANADIAN NORTHERN.—Wm. A. Read & Co., New York, are offering the unsold portion of \$3,000,000 Winnipeg Terminals 4 per cent. bonds of July 1, 1909-1939, at 99½. The bonds are a direct obligation of the Canadian Northern and are guaranteed, principal and interest, by the Province of Manitoba. They are specifically secured by a mortgage on about 169 acres of land with freight and passenger terminals of the Canadian Northern at Winnipeg, Man.

CENTRAL NEW ENGLAND.—The New York State Public Service Commission, Second district, has authorized this company to abandon that portion of its line between West Pine Plains and West Salt Point, Dutchess county, including the agency at Hibernia and flag stations at West Eno and East McIntire. It was shown that the company owns parallel lines between the points in question, which will furnish adequate service.

CHICAGO, ROCK ISLAND & PACIFIC.—Speyer & Co. have bought \$5,300,000 of 4½ per cent. equipment gold notes of the Chicago, Rock Island & Pacific Railway Company, series C. These bonds will mature in 20 semi-annual instalments of \$265,000 each, from April 1, 1910, to October 1, 1919. The equipment consists of about 85 locomotives, 100 passenger cars and 3,000 other cars.

COLUMBUS, MARION & BUCYRUS.—On application of the Cincinnati Trust Company, John G. Webb, of the Webb Construction Company, concurring, the common pleas court at Marion, Ohio, has appointed Eli West, of Columbus, and George Whysall, of Marion, co-receivers for this company. The road was built from Marion to Bucyrus two years ago and has been operated by the Webb Construction Company, the property never having been turned over to the railway company, the stockholders of which were practically the same as those of the Columbus & Marion Electric railway, which went into the hands of a receiver some weeks ago. The petition recited that the company has a bonded indebtedness of \$500,000 and that interest amounting to \$12,500 is due and unpaid. In addition the railway company is indebted to the trust company in the sum of \$7,500 in borrowed money.

EASTERN OF CUBA.—The property of this company has been bought at foreclosure sale by I. McD. Garfield and P. C. Anderson, of New York, representing the reorganization committee. (Feb. 5, 1909, p. 283.)

JAMESTOWN, FRANKLIN & CLEARFIELD.—See Lake Shore & Michigan Southern.

LAKE SHORE & MICHIGAN SOUTHERN.—The Jamestown, Franklin & Clearfield has obtained trackage rights over the line of the Allegheny Valley Railway of the Pennsylvania from Rose Siding, Pa., to Falls Creek, 22 miles, and has also obtained trackage rights over the line of the Buffalo, Rochester & Pittsburgh from Falls Creek to Clearfield, 31 miles. The operation of this line will begin about September 15.

LONG ISLAND.—An application for permission to issue \$16,500,000 ten-year 4 per cent. bonds was heard by the state Public Service Commission at Albany, N. Y., Sept. 14. It was shown that the Pennsylvania Railroad Company, the largest stockholder of the Long Island, had since 1905 advanced \$14,000,000 for improvements, of which \$8,000,000 had been paid by the sale of bonds and \$6,000,000 remained unpaid, and is proposed to be taken care of by the securities to be issued;

and the sum of \$10,500,000 is required for improvements about to be made.

NEW YORK, NEW HAVEN & HARTFORD.—See Central New England.

PAN-AMERICAN.—According to a press despatch from Mexico Sept. 14, David E. Thompson, American Ambassador to Mexico, has obtained control of this company. The line extends from San Geronimo, on the Tehuantepec National, to Mariscal, on the Mexican-Guatemalan frontier. Ambassador Thompson did not make public the purchase price, but said that he would have the controlling interest in the property, having obtained by purchase \$9,600,000 worth of the stock. The line is 244 miles long and was formerly owned principally by men in Los Angeles and St. Louis. Mr. Thompson says that the line is the only feasible route for entrance into Central America. The road will be improved.

PENNSYLVANIA.—See Lake Shore & Michigan Southern.

ST. JOSEPH, SOUTH BEND & SOUTHERN.—Beside the usual semi-annual dividend of 1 per cent. an extra dividend of ½ per cent. has been declared on the outstanding \$500,000 common stock. An extra dividend of ½ per cent. was paid last March. The road, which is leased to the Chicago, Indiana & Southern, runs from South Bend, Ind., to St. Joseph, Mich., 39 miles.

SAN DIEGO & CUYAMACA RAILWAY.—On September 1 this new company took over all the property of the San Diego, Cuyamaca & Eastern, and the road is now operated under its new title. The names of the officers are given in another column.

SEABOARD AIR LINE.—The reorganization plan (July 9, p. 81) has been declared operative and the time for depositing bonds has been extended to October 1. Stockholders of record September 28 are entitled to subscribe for the \$18,000,000 new adjustment bonds at 70 in accordance with the plan.

SUGARLAND.—The railway, 7½ miles long, connecting the Texas state penal farm with the International & Great Northern, has been sold by the state of Texas to W. T. Eldridge, president of the Sugarland Railway and proprietor of large sugar plantations. Mr. Eldridge pays \$32,000 and agrees to put the road in good condition and to extend it 2½ miles. In the extension and repairs convict labor will be employed. The grading for the extension will be done by the state. This will require but little work. The purchaser also agrees to buy the sugar cane produced on the state lands during the next two years at a fixed price. It is said that the new owner is planning to build an extension of about 20 miles to the House Plantation & Refining Co. With such an extension Mr. Eldridge would have control of about 45 miles of railway in the sugar plantations in and about Sugarland.

WESTERN OHIO.—The details have been completed of an issue of notes amounting to \$360,000, drawing 6 per cent. interest, to take up floating indebtedness. The notes are secured by \$500,000 of the company's first mortgage bonds. Cleveland banks and trust companies took the entire issue.

WEST JERSEY & SEASHORE.—A semi-annual dividend of 2½ per cent. has been declared, payable October 1, on the outstanding \$9,461,600 common stock. This compares with 2 per cent. paid in March and in September, 1908, and in April, 1909, and 3 per cent. paid semi-annually from September, 1905, to September, 1907.

The recently completed railway line from western Austria through the Alps to Trieste is really one of the great works of modern times. While it has no tunnel comparable to the Gotthard or the Simplon, it has four whose aggregate length is more than 17 miles, the longest being 5.4 miles and another more than five miles; but besides these there are no less than 68 other tunnels on the line. All kinds of unforeseen difficulties were encountered in these tunnels. In one, not very far from Trieste, two great caves were opened, and it was necessary to bridge them. In another the floor of the tunnel was forced upward nearly 6 ft. In another the inner tension of the rock split off huge plates of gneiss.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Chicago Great Western is said to have ordered 34 locomotives. This is not yet confirmed.

The Nevada Northern has ordered one consolidation locomotive from the American Locomotive Co.

L. J. Smith, Kansas City, Mo., has ordered five consolidation locomotives from the American Locomotive Co.

The Wichita Falls & Southern has ordered two mogul locomotives from the Baldwin Locomotive Works for December delivery.

The Northern Pacific, as mentioned in the *Railroad Age Gazette* of September 10, has ordered 40 mikado and 15 six-wheel switchers from the American Locomotive Co.

The Chicago Great Western has ordered 10 mallet compounds, 20 consolidation locomotives and four ten-wheel passenger locomotives from the Baldwin Locomotive Works.

The Baltimore & Ohio has ordered from the American Locomotive Co. and the General Electric Co. the two electric locomotives mentioned in the *Railroad Age Gazette* of August 20.

The Monongahela has ordered from the American Locomotive Co. six consolidation locomotives. This order includes the engines mentioned in the *Railroad Age Gazette* of August 13.

The Atchison, Topeka & Santa Fe has ordered nine Pacific locomotives from the Baldwin Locomotive Works, and is said to have ordered also 18 Atlantic type. The latter is not confirmed as yet. These locomotives are in addition to the order mentioned in the *Railroad Age Gazette* of July 9.

The Lake Superior & Ishpeming has ordered eight consolidation locomotives from the American Locomotive Co., as mentioned in the *Railroad Age Gazette* of August 13. Delivery is set for December.

General Dimensions.

Weight on drivers	152,000 lbs.
Total weight	174,000 "
Cylinders	20 in. x 28 in.
Diameter of drivers	56 in., over tires.
Type of boiler	Straight top
Working steam pressure	200 lbs.
Heating surface, tubes	2,038 sq. ft.
" " firebox	155 "
" " total	2,193 "
Tubes number	270
" outside diameter	2 in.
" length	14 ft. 6 in.
Firebox, type	Narrow
" length	108 in.
" width	41 in. inside
" material and maker	Otis steel
Grate area	37 sq. ft.
Tank capacity for water	6,000 gal.
Coal capacity	12 tons

Special Equipment.

Bell ringer	Golmar
Brakes	Westinghouse automatic and straight air
Brake-beams	National Hollow
Driving boxes	Cast steel
Headlight	Star
Injector	Nathan Simplex
Safety valve	Nathan
Sanding device	Leach type
Sight-feed lubricators	Nathan
Springs	Pittsburgh
Staying	Ewald
Tires	Midvale
Tubes	Detroit cold-rolled
Valve gear	Baker-Pilliod
Wheel centers	Cast steel

CAR BUILDING.

The Atlantic Coast Line has ordered 50 Rodger ballast cars.

The Spokane & Inland has ordered 16 cars from the J. G. Brill Co.

The Swift Refrigerator Transportation Co. is expecting to build 200 cars.

The Lehigh Valley is in the market for 1,000 hopper cars, 1,000 gondolas and 1,000 box cars.

The Mather Stock Car Co. has ordered 100 thirty-ton gondolas from the Standard Steel Car Co.

The Duluth & Iron Range is said to be in the market for 1,000 ore cars. This is not yet confirmed.

The Cumberland & Pennsylvania is said to be in the market for freight cars. This is not yet confirmed.

The Chicago & Oak Park Elevated has ordered 20 sets of trucks from the McGuire-Cummings Manufacturing Co.

The Illinois Traction Co. is said to have ordered 30 electric cars from the J. G. Brill Co. This is not yet confirmed.

The Chicago City Railway Co. is expected to place an order within a few days for 50 additional pay-as-you-enter cars.

The Northern Pacific is in the market for 100 thirty-ton refrigerator cars and 75 to 100 passenger train refrigerator cars.

The Houston & Texas Central is at present receiving an order of 10 all-steel coaches, the first steel cars to be used on the line.

The Chicago Great Western has ordered 2,000 box cars and 250 stock cars from the American Car & Foundry Co., and 200 Rodger ballast cars. The order for box cars includes the 1,500 mentioned in the *Railroad Age Gazette* of August 20.

The Great Northern, as noted in the *Railroad Age Gazette* of September 3, has ordered 30 baggage cars, 30 coaches, 6 tourist sleepers, 12 sleepers and 5 diners from the Barney & Smith Car Co. and 10 combination baggage and mail cars from the American Car & Foundry Co.

IRON AND STEEL.

The Southern is in the market for 150,000 pairs of rail joints.

The Wabash has ordered 2,500 tons of rails from the Carnegie Steel Co.

The Milwaukee Electric Ry. has ordered 2,500 tons of rails from the Pennsylvania Steel Co.

The Dallas Interurban Electric Ry. is in the market for 200 tons of rails and the necessary fixtures.

The Whipple Car Co., Chicago, has ordered 177 tons of structural steel from the McClintic-Marshall Construction Co.

The Chicago Great Western has ordered 20,500 tons of open hearth rails from the Carnegie Steel Co. This includes the 10,000 tons mentioned in the *Railroad Age Gazette* of August 20.

The Electric Traction Construction Co., Commerce building, Kansas City, Mo., which is to build the Interstate Railway from Kansas City to St. Joseph, Mo., is in the market for 5,000 tons of 70-lb. rails and 150,000 railway ties.

General Conditions in Steel.—There are inquiries in the market for about 240,000 tons of heavy rails for next year's delivery. Prices on steel plates, shapes and bars have been advanced. It is estimated that during August a total of about 2,500,000 tons of steel was ordered. It is expected that the next quarterly statement of the United States Steel Corporation will show an unfilled tonnage of more than 5,000,000 tons. At present the unfilled tonnage equals about five months' production of the corporation.

RAILROAD STRUCTURES.

AMARILLO, TEX.—*The Atchison, Topeka & Santa Fe* is putting in an 85-ft. turntable with an air tractor.

ANDERSON, IND.—*The Indiana Union Traction Co.* has plans made for a bridge over the White river at Anderson and another over Buck creek at Yorktown, Ind.

ARKADELPHIA, ARK.—*The St. Louis, Iron Mountain & Southern* station was burned recently, with an estimated loss of \$200,000.

BALTIMORE, MD.—Work is now under way on a brick car house with terra cotta trimmings for the United Railways &

Electric Co. on a site opposite Druid Hill Park, in Baltimore. See Western Maryland under Railroad Construction.

BATON ROUGE, LA.—The Louisiana Railway & Navigation Co. will build a passenger station.

CHANUTE, KAN.—The Atchison, Topeka & Santa Fe has authorized the building of a new freight house to cost \$36,000.

CLEBURNE, TEX.—Among the yard improvements now being made by the Gulf, Colorado & Santa Fe is a building 40 ft. x 60 ft. to be used in instructing machinist apprentices.

DALLAS, TEX.—The Dallas Interurban Electric Ry. expects to build a bridge 500 ft. long to carry two tracks, two roadways and two footpaths.

DETROIT, MICH.—The Common Council at a recent meeting adopted an ordinance agreeing to the terms pending between the city and the Michigan Central for the erection by the railway company of a new station and terminals to cost \$2,000,000. The company has 60 days in which to accept the agreement.

ESCANABA, MICH.—The new No. 5 dock to be built by the Chicago & North Western at Escanaba during the coming winter will cost about \$1,000,000. When finished it is said this will be the largest iron ore dock in existence. As soon as the old No. 5 dock is removed work on the new one is to be started. It is expected to have the new dock ready for service in the early part of next summer.

FITZGERALD, GA.—The Atlanta, Birmingham & Atlantic, it is said, will let contracts soon for putting up a passenger station in Fitzgerald.

FORT MADISON, IOWA.—The Atchison, Topeka & Santa Fe has authorized a new brick veneer passenger depot to cost \$14,000. The old building will be used as a freight house.

GEORGETOWN, WASH.—According to reports the railways will put up a large viaduct on Alki street, in Georgetown, to cost \$20,000.

GLAZIER, TEX.—The Atchison, Topeka & Santa Fe is building a new steel tank and pump house to cost about \$10,000.

JOPLIN, MO.—An officer of the Atchison, Topeka & Santa Fe writes that that company, the Kansas City Southern and the Missouri & North Arkansas will jointly put up a union station at Joplin. Plans have not yet been decided upon as to what kind of structure will be put up.

KANSAS CITY, MO.—At a special election September 9 an ordinance, permitting the construction of the new union station, was ratified by the electors. Under the terms of the ordinance the station is to be finished within four years. See mention of this improvement under General News. (Aug. 13, p. 300.)

LIMA, OHIO.—Bids have been received for a \$50,000 union interurban station to be used by the Western Ohio and allied lines. It will be a two-story building, the second story to be used for traffic department offices.

MARCUS, WASH.—The Great Northern is said to be putting up a six-stall roundhouse and a machine shop 50 ft. x 160 ft., with concrete foundations, in Marcus.

MEMPHIS, TENN.—The railways interested in putting up a union passenger station at Memphis at a meeting held last week failed to reach an agreement. The Illinois Central, the Louisville & Nashville and the Scathern have under consideration plans for independent stations, but it is not known whether these plans will be carried out.

MONTICELLO, WIS.—The Illinois Central is planning to rebuild the bridge between Monroe and Monticello which was recently burned.

NEW CASTLE, IND.—An officer of the Pennsylvania writes regarding the reports that a new passenger station is to be put up at New Castle that the question has been under consideration but nothing definite has been done as yet.

NEW IBERIA, LA.—An officer of the New Iberia, St. Martin's & Northern writes that a site of land in the heart of the city and fronting on the Bayou Teche has been bought with the purpose of building a passenger station and freight terminals at an early date.

OTTAWA, ONT.—Bids are wanted by P. E. Ryan, secretary of the Transcontinental Railway Commission, up to September 23 for putting up five steel bridges in District A on the National Transcontinental (Grand Trunk Pacific), and seven steel bridges in district D.

PHILADELPHIA, PA.—An officer of the Philadelphia & Reading writes that as soon as the track elevation work in Philadelphia between Huntingdon and Norris streets is finished work is to be started on a new passenger station at Huntingdon street. A contract has been let for the structure to replace the present station and work is under way removing the old building. The new station will be of red brick, one-story high, 21 ft. x 87 ft., with an extension 18 ft. x 10 ft. There will also be a shelter with umbrella sheds. A temporary frame passenger station 38 ft. x 50 ft., with a detached baggage room 14 ft. x 25 ft., is being put up at Columbia avenue.

PUNXSUTAWNEY, PA.—An officer of the Buffalo, Rochester & Pittsburgh writes that work is now under way putting up a reservoir at a point about three miles from Punxsutawney to furnish pure boiler water to the terminal at Punxsutawney. The dam is to be about 35 ft. high and 700 ft. long and will be constructed of earth, with concrete core wall. The reservoir will have a storage capacity of 110,000,000 gallons and water will be supplied by gravity through an 8-in. cast iron pipe three miles long. All the work is being done by the company's men.

SASKATOON, SASK.—Bids are wanted September 22 by G. T. Clark, city engineer, for the construction of a subway under the tracks of the Canadian Northern in Saskatoon.

SEATTLE, WASH.—Terminal franchises granted by the city to the four railways entering Seattle require the construction and maintenance of such overhead street crossings as the city may demand.

SHULTER, OKLA.—Press reports say that the St. Louis & San Francisco will build a passenger station.

SPOKANE, WASH.—The Spokane Traction Co. plans to build a bridge at East Boone avenue.

SPRINGFIELD, OHIO.—The Detroit, Todelo & Ironton will build a new steel bridge at Plum street.

TACOMA, WASH.—According to local press reports, the Oregon & Washington has let a contract to Dibble & Hawthorne for six miles of yard tracks and a temporary freight shed.

According to reports the Northern Pacific will make improvements at South Tacoma to double the capacity of its shops.

A permit has been given to the Hurley-Mason Co. to put up a new station for the Northern Pacific, to cost \$500,000. The work is to be started at once.

Plans are said to have been submitted to the city authorities for approval for the passenger station to be used jointly by the Union Pacific and the Southern Pacific.

TASCOSA, TEX.—Fourteen spans of the Fort Worth & Denver City Railway bridge over the Canadian river at Tascosa was carried away by floods on September 7.

WAYNOKA, OKLA.—A new brick eating house is to be built by the Atchison, Topeka & Santa Fe. The building will cost \$16,000.

SIGNALING.

The Baltimore & Ohio is now so extensively equipped with block signals that the signal maintenance forces have been reorganized by shortening the districts and employing additional men. Heretofore the men in charge of signal maintenance on the Cumberland, Connellsville, Pittsburgh, New Castle, Wheeling and Chicago divisions have reported to the master carpenter, but such organization will be discontinued and signal supervisors appointed, who will report to the division engineers. The men engaged in the maintenance of signal appliances, including lampmen, will report to the signal supervisors. Signal Engineer Patenall will have monthly meetings of his staff at headquarters in Baltimore, to be attended by the signal supervisors and the inspectors.

Supply Trade News.

The Scullin-Gallagher Iron & Steel Co., St. Louis, Mo., will build a pattern shop, 75 ft. x 200 ft., to cost about \$10,000.

The T. H. Symington Co., Baltimore, Md., has opened a permanent office at 30 Church street, New York, in charge of T. C. de Rosset.

Roswell P. Cooley, formerly mechanical inspector for the Pullman Co., Chicago, has resigned to take a position with the Chicago Car Heating Co., Railway Exchange, Chicago.

Azor R. Hunt, general superintendent of the Homestead works of the Carnegie Steel Co., Pittsburgh, Pa., has been elected a director of the company, succeeding William H. Singer.

The Hanlon Locomotive Sander Co., Winchester, Mass., has orders to equip with sanders the 100 locomotives now being built by the American Locomotive Company for the Western Pacific.

It is understood that the Lake Superior & Ishpeming, which recently ordered eight new locomotives, will sell seven old ones, consisting of four compounds and three four-wheel switchers.

The American Car & Foundry Co. is in the market for a 375-h.p. gas engine, vertical type preferred, with a speed of 175 to 225 r.p.m.; also a 220-volt d.c. generator, to be direct connected to the engine.

B. L. Lockwood, who was formerly mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis, at Indianapolis, Ind., has been made assistant chief engineer of the Pressed Steel Car Co., Pittsburgh, Pa.

B. L. Verner, formerly assistant purchasing agent for the Republic Iron & Steel Co., Pittsburgh, Pa., has resigned that position and has been appointed sales manager of the Blue Island Car & Equipment Co., 607 Fisher building, Chicago.

The Juragua Iron Co., South Bethlehem, Pa., recently purchased three saddle tank locomotives from the Vulcan Iron Works, Wilkes-Barre, Pa. These locomotives will be put in service in connection with the ore operations of this company in Cuba.

The Pilliod Company, Chicago, has orders for equipping the following engines with the Baker-Pilliod valve gear: Six Pacific engines, Norfolk & Western; six consolidation engines, Monongahela R. R., and eight consolidation engines, Lake Superior & Ishpeming.

F. E. Symons has been appointed western sales manager of the Ralston Steel Car Co., Columbus, Ohio, with office in Chicago, to succeed J. L. Connors, who has been transferred to the Columbus office. Mr. Symons has been assisting in the Chicago office for several months.

The fire at the Cincinnati plant of the S. Obermayer Co., Cincinnati, Ohio, on the night of September 11 merely damaged the warehouse; no damage was done to the various manufacturing departments. There will be no interruption to business or the prompt filling of orders.

The Westinghouse Air Brake Co., Pittsburgh, Pa., has declared the regular quarterly dividend of 2½ per cent. and an extra dividend of 1½ per cent. This is the first extra dividend paid in the calendar year 1909. The total dividends paid in 1908 were 12½ per cent., and in 1907, 20 per cent.

W. L. Allison, recently mechanical engineer of the Atchison, Topeka & Santa Fe, has been made mechanical manager of the Franklin Railway Supply Co., New York, with headquarters at 30 Church street, New York. He succeeds A. G. Elvin, who has been made assistant to the vice-president of the company.

P. W. Hamill, who for six years has been western manager for F. W. Bird & Son, East Walpole, Mass., manufacturers of car roofing and insulating paper, has resigned. He has bought

a large tract of Oregon land, where he will engage in fruit raising. He is succeeded by M. L. Caton, who formerly represented the company in Detroit, Mich.

Joseph T. Ryerson & Son, Chicago, are now working on the order for punches and shears for the new Dunkirk shops of the American Locomotive Co. The same firm secured the order for the majority of the machines in the boiler shop and blacksmith shop of the new Macon shops on the Central of Georgia. The order includes hydraulic wheel presses, flanging presses, accumulators, pumps, steam hammers, punches, shears and saws.

The Kensington all-steel journal box, made by the Union Spring & Manufacturing Co., Pittsburgh, Pa., has been specified for use on the following equipment: 2,600 coke cars, Pennsylvania Lines West; 2,450 freight cars, Pennsylvania Railroad; 2,500 coal cars, Chesapeake & Ohio; 300 coal cars (to be built at the Roanoke shops), Norfolk & Western; 120 cars, Vandalia; 140 cars, Grand Rapids & Indiana, and 250 flat cars, Western Pacific.

The O. M. Edwards Co., Syracuse, N. Y., has orders for trap-doors and window fixtures for the 100 Long Island passenger cars, to be built at the American Car & Foundry Co. The Edwards' steel trap-door is also to be used on the 55 new coaches for the Baltimore & Ohio. Steel trap-doors and window fixtures will also be used on the five new cars for the Chicago & Alton. Several large orders for window fixtures have been received for export trade. The factory force has been doubled within the last two weeks, and the plant is also working overtime to meet the large number of rush orders which it now has on hand.

The Alexander Milburn Co., Baltimore, Md., has enlarged its factory and increased its staff for manufacturing the Milburn acetylene contractor's light. Among recent customers for the 5,000-c.p. lights are: Grant Smith & Co. & Locher, Grosse Isle, Mich.; Smith-McCormick Co., Portland, Pa.; F. J. Romer Construction Co., St. Paul, Minn.; American Pipe & Construction Co., Rochester, N. Y.; Erie Railroad; Johnson-Dauchy & Carey Co., Mandan, N. Dak.; Meadows Co., Johnson City, Tenn.; United States Reclamation Service; United Engineering & Contracting Co., Lockport, N. Y., and many others.

Returns of the Western Electric Co., Chicago, for August show that the month ran 60 per cent. ahead of August, 1908; also showing a gain of about 5 per cent. over July. August, 1909, was 10 per cent. ahead of August, 1907, the year in which the Western Electric's sales reached \$53,000,000, the second largest total in the history of the corporation. At the rate of the August increase, the business for the current year would run in excess of \$53,000,000. The three quarters of the fiscal year which have elapsed indicate gross sales for the year of about \$47,000,000. While this figure is far below the \$69,000,000 total for 1906, and the \$53,000,000 for 1907, it is eminently satisfactory, as compared with last year, representing a gain of \$14,000,000. The year to date has been marked by especially good sales in cable, electric machinery and general electric light supplies, and in these lines many records of other years have been broken.

The strikers at the plant of the Pressed Steel Car Co., Pittsburgh, Pa., returned to work last week. The company issued the following statement: "The company has not agreed or promised at this time to increase the wages of its workmen, but does expect that as general business conditions improve its workmen will share in the benefits resulting therefrom. Up to the present time, while there have been additional orders for cars, there has been no improvement in prices. The company has not promised to abandon the 'piece pooling system,' but if it develops that this system can be improved by increasing the number of pools and reducing the number of men in a pool, this will be done. The company has arranged that the amount deducted for accident insurance shall be plainly stated on the pay envelope and the men receive cards certifying that they are entitled to benefits under the insurance plan. The company has never knowingly tolerated any imposition upon its employees and intends that all employees shall always have fair and proper treatment. For this purpose it has established an information bureau for the inves-

tigation of any complaints its employees make, and all complaints that have already been made have been and will be promptly investigated. The company will not tolerate any graft or other imposition."

High Efficiency Transmission Circuit for Telephone Train Despatching.

BY H. L. BURNS.

The use of the telephone for train despatching is not by any means new. For several years a number of railways have been using the ordinary local battery, bridged telephone for this purpose, the stations being called by code ringing; but when the attempt was made to use this arrangement on long lines with a considerable number of sta-

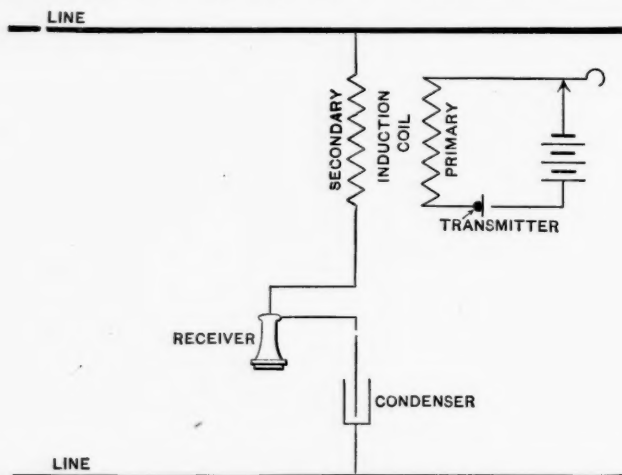


Fig. A—Simple Telephone Circuit.

tions it was found that the transmission would be seriously impaired when one or more of the receivers were off from the hook at the same time. This difficulty was very noticeable when selectors began to be used. Fig. A herewith shows the usual arrangement of a local battery telephone. Originally this arrangement was used at both the despatcher's and the way stations. It will be seen that the bridge during conversation consists of a condenser, the receiver and the sec-

ondary of the induction coil, in series. The total impedance of this bridge to talking currents is approximately 600 ohms, about 300 ohms of which are in the receiver and therefore active for receiving purposes. It is obvious that when a number of these sets are bridged across the line at once, the joint impedance of the bridges in parallel is very low and the transmission correspondingly difficult between terminals or widely separated stations.

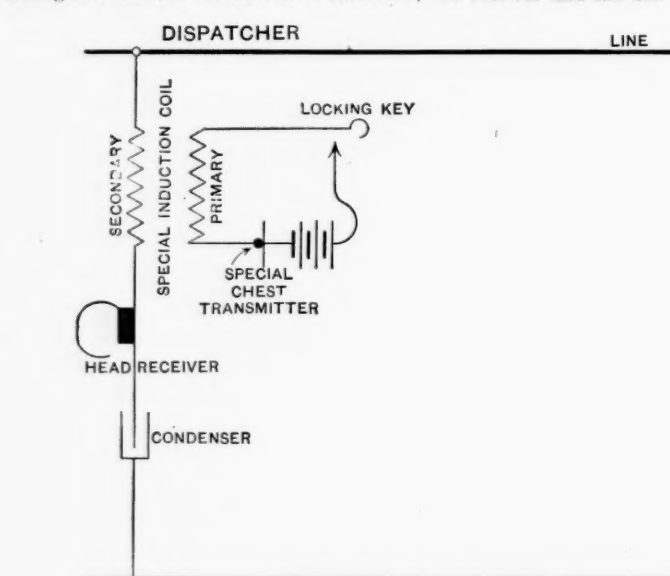


Fig. B—Improved Telephone Circuit.

ondary of the induction coil, in series. The total impedance of this bridge to talking currents is approximately 600 ohms, about 300 ohms of which are in the receiver and therefore active for receiving purposes. It is obvious that when a number of these sets are bridged across the line at once, the joint impedance of the bridges in parallel is very low and the transmission correspondingly difficult between terminals or widely separated stations.

An improvement on this arrangement, so far as transmission is concerned, was effected by using a larger induction coil having a low impedance primary and a high impedance secondary. The larger coil improved the outgoing transmission considerably, but this arrange-

ment is not so efficient for receiving, so that the gain resulting was not great.

To meet conditions imposed by this class of service, the Western Electric Co., Chicago, has devised the circuit shown in Fig. B. The despatcher's equipment is substantially the same as shown in Fig. A. In order to provide the despatcher with the best possible receiving he is provided with instruments of fairly low impedance. A head receiver is used and is in series with the induction coil; the latter is specially designed to give the best possible transmitting consistent with good receiving. A locking transmitter key is provided, inasmuch as the despatcher will ordinarily require both hands for his work. The transmitter itself is of the chest type.

It will be noted that the way station circuit is radically different from that shown in Fig. A. In order that a number of stations may be listening at once without serious detriment to the transmission, it is apparent that each must constitute, when listening takes place, a bridge of very high impedance. Further, in order to give efficient receiving, a large proportion of this impedance must be in the receiver itself. This precludes the possibility of having the receiver in series with the induction coil because, when transmitting, all the secondary talking current passes through the receiver. The high impedance of the receiver would cut down the transmitted current and, in addition to this, there would be the serious objection of excessive side tone.

A study of these conditions led to the conclusion that the use of a push button or key, which in its normal position gives the best possible receiving conditions, and in its operated position gives the best possible transmitting, would be advisable. In this arrangement (Fig. B) normally, i. e., in the listening condition, there is a circuit through the receiver and condenser in series directly across the line. When the key is thrown to the talking position it is seen that the receiver in series with a retardation coil (normally short circuited) is put in parallel with the secondary of the induction coil and these bridged across the line through the condenser.

When the key is normal the receiver is directly across the line through a condenser, which gives the best possible receiving conditions. The receiver is specially wound, and the impedance of the bridge at this time is about 2,400 ohms to talking current, practically all of which is in the receiver and consequently active for receiving. When the key is depressed, the induction coil being bridged directly across the line through the condenser gives the best possible condition for transmitting. The function of the retardation coil is to prevent excessive side tone in the receiver when talking, also by raising the impedance of the receiver circuit, more of the transmission is forced upon the line. This retardation coil is so designed that in case the despatcher wishes to break in, a sufficient volume of the despatcher's voice currents will pass through the receiver to attract the operator's attention.

The induction coil and transmitter are also special for this purpose. Three cells of dry battery or their equivalent are used for transmitted battery, the latter being in use only during the time the operator is actually talking. In developing this circuit and apparatus, the problem has been studied as a whole rather than as a problem of transmitting or of receiving alone. The various pieces of apparatus have been designed to work together, having in view the best possible results as a whole. This circuit is in use on lines up to over 200 miles, with as many as 45 stations; 20 of these stations can be listening simultaneously without seriously impairing the transmission on the line.